THE SEVEN SOURCES OF HEALTH.

A MANUAL OF ALL THAT CONCERNS THE PRESERVATION OF HEALTH AND THE PREVENTION OF DISEASE, BOTH OF BODY AND MIND, BASED UPON THE LATEST PHYSIOLOGICAL DATA.

BY

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SECOND THOUSAND.

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TO

ROBERT CHRISTISON, M.D., V.P.R.S.E.,

PROFESSOR OF MATERIA MEDICA (INCLUDING DIET AND REGIMEN), IN THE UNIVERSITY OF EDINBURGH.

Dear Dr. Christison,—

I know of no man to whom I can inscribe this little work with so much propriety as to you. Not that I desire to place my own opinions under the shelter of your great authority; but because you have devoted a large portion of a very active life and a powerful intellect to the elucidation of the effects of natural agents upon the human frame.

In placing your opinions upon these subjects on record, you have had the independence of mind to disregard passing popularity, so easily obtained by those who do not scruple to pander to the popular prejudice by attributing the largest portion of all diseases to dirty streets, crowded dwellings, and insufficient food, to the exclusion of individual regimen, temperance, and purity.

The precepts which I imbibed from your teaching in former years have borne fruit in the opinions which I have formed from a not inconsiderable extent of observation; and it is highly satisfactory to me to find that those opinions accord in the main with the results of your very matured experience.

I am, dear Dr. Christison,

Gratefully and respectfully yours,

William Strange.

PREFACE.

It has been said that he who essays to write a new book upon an old subject is bound either to add new facts to the old stock, or to serve up existing materials in a more effective or more attractive form than his predecessors have done. In composing the present little book, the author has endeavoured to keep this precept in view; and, by adding such new facts as have recently been admitted into the domain of Science, whilst he has supervised the old, and by endeavouring to place both in the most logical and sequential order of which they seem capable, to conform as much as he was able to the requirements of the precept in its double aspect.

The whole subject has therefore been carefully surveyed, and an endeavour is here made to present it to the reader divested of all technicality, and in such a popular and didactic form, as, it is hoped, will tend to fix the principles upon which the preservation of health must rest, firmly in his mind.

With a view to brevity, all extraneous matter, and facts not bearing directly upon the subject in hand have been cast into foot-notes, and by omitting anecdotes, &c. the work has been compressed into as small a compass as possible, consistently with the proper handling of each department of the subject. And this must be the Author's excuse for any excessive terseness which may be observed in his style.

The works of former writers of any celebrity on the subject, such as those of Sir John Sinclair, Mr. Mayo, Mr. Davis, Drs. Paris, Prout, Andrew Combe, and others, have been carefully examined; whilst for many recent facts the Author is indebted to those of Drs. T. K. Chambers, Brinton, and

Edward Smith; chiefly in the department of food, digestion, and diet.

As regards what is said under the head of alcoholic beverages, the Author has formed his own opinions unbiassed by those of either party in the temperance controversy. He is happy to find that this opinion, based upon a pretty large experience of the effects of alcohol upon individuals of every class, ranges, in the main, on the side taken by the careful observers just mentioned.

The Author has found it necessary to combat some, at present, popular opinions, with reference to ventilation; and if he has found it necessary to object to some of the teachings of a much venerated lady in respect to these points, his reasons for doing so will be found fully set forth in their appropriate places.

The work is divided into seven chapters. In the first a succinct account of the principal functions of the body is given, and the differences in temperament, habit, and predisposition pointed out. In each of the five following chapters the influence of one of the great natural stimuli upon the functions of the body is examined in detail;—thus, AIR, LIGHT, TEMPERATURE, FOOD and DRINK, and EXERCISE, are separately examined as to the effects of their proper use in eliciting normal functions, and of their abuse in disturbing these functions so as to produce disorder and disease, instead of regularity and health.

The last chapter is devoted to an exposition, necessarily brief, of the exercise of the powers and affections of the mind in its intercourse with the world, in such manner as will conduce to the healthy performance of all its operations, and so as truly to present that inestimable blessing of the "MENS SANA IN CORPORE SANO."

WORCESTER, *March*, 1864.

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SEVEN SOURCES OF HEALTH.

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Definition of Health.—At the beginning of a treatise on the laws of health, it may naturally be asked that a definition of the term should be given. This, however, it is not easy to do. Health is a mere abstraction, made up of a variety of ideal images which present themselves in a different guise to the mind of almost every individual. What would be described by the sickly denizen of our large towns as health, would be looked upon by the ruddy countryman as only its pitiful caricature. Could the asthmatic but recover the ability to breathe freely in all places, and in all states of the atmosphere, though perhaps otherwise far from robust, he would hail his new condition as one of perfect recovery—entire health. So the

dyspeptic, who suffers agonies of gastric remorse after the slightest excess, would regard the power of digesting a meal composed of his favourite dishes as more than making up for all the other evils which an habitual breach of the laws of diet had entailed upon him.

There is no doubt that our ideas of health are compounded and made up of the good qualities of several distinct individuals: the fine chest and perfect wind of one, the powerful circulation and good animal spirits of a second, the digestion of a third, which refuses nothing, and the muscular and locomotive power of another, which seems never to lessen or tire. If to these we add the ability to resist the vicissitudes of weather, the effects of bad sanitary arrangements, and of epidemical influences, we shall have our perfect ideal, our abstraction — health. Thus, as every individual will have his own ideal standard of health, so will he have formed by experience a notion which, *to him*, shall represent its reality. Those functions of his body which he feels to go on with regularity and comfort to himself, producing no after effects of exhaustion or pain, are set down as healthy. There may be others which he is conscious are not so well performed, and the action of which is productive of discomfort. If these could be rectified, and brought into the same harmony with his feelings as the others, he would pronounce himself *well;* for him, in perfect health.

For him. This reservation or restriction of the general term indicates that health is individual: large in one, less in another; yet in each, health. And hence have arisen such terms as robust and delicate, strong and weak, good, tolerable, and the like, as applied to the health of different persons, or of the same person in different states of his organism. There exists, then, no standard with which we can

bring all the varied conditions of the bodily frame into comparison. Health is a *beau-idéal*, the condition of the system which all wish for, few think they possess in its true perfection. The screw loose in our own mechanism may be hidden perhaps from the eye of our neighbour, who, himself unsound, looks upon us with envy as possessing that blessing which he so ardently longs for.

The cause of this want of unity in the standard of health must be sought for in the very nature of vital action, or life. The movements of all living beings are the result of the operation of external forces or stimuli, acting on an organized frame. The mutual reaction of these—the organism on the one hand, and the vital stimuli on the other—equals vital force; and the vital force in operation represents all the various functions of living bodies.

The organization of every living body, whilst preserving its characteristic and specific properties in each individual of the species, exhibits a very considerable range of variation. To this circumstance are due the peculiarities of race, class, and individual; representing all those diversities of frame, character, and habit, both of body and mind, which, when we consider that probably no two individuals of countless millions were ever exactly similar in all respects, must strike the mind with amazement.

This diversity of organization is displayed in various ways: in the quantity of the material composing the organism—size; in the mutual relation of one organ to another—balance of organs; and in the quality, absolutely speaking, of the mechanism. Even where little or no difference can be discerned in the constitution of two individuals, very great variations in their several functions will show themselves on careful examination, just as two steam-engines, built exactly alike in every respect, of the same quality of metal,

of the same size and weight, and by the same artificer, will display very different *tempers* in their working, and such as to baffle their engineers to account for; so the temper of the organization, the nicety of the internal mechanism, is found to differ much in individuals whose external conformation may appear as nearly as possible alike.

The original conformation and individual temperament of the organs must, therefore, be taken into account as one of the principal factors in the complex result of function which we call Health. Nothing but experience, and that the experience of the individual himself, can appraise its amount or value with any approach to accuracy.

In order to obtain a logical and systematic view of the subject, it will be well to glance, in the first place, at the several modes in which the *quality* of the organism may be permanently affected. An estimate of these difficulties will free us from the error of supposing that the same natural agents applied to the body must necessarily induce similar effects in all cases.

The first great requisite to perfection of bodily structure is sufficiency of the generative force in action at the time of the first formation of the embryo, whether plant or animal. The offspring of parents debilitated by want, disease, or old age, are very generally deficient in one or more of the three requisites above-mentioned—viz., size, proper balance of organs, or quality of mechanism. But the children of parents who may not have been subjected to an unusual amount of these debilitating agents, yet have been under-sized or ill-organized from their birth, are still more frequently the subjects of deformity, incompleteness of function, or other deficiency of vital force. Hence, hereditary peculiarities or defects of structure are much more readily handed

down to descendants than are those which are acquired in after-life, through the adverse circumstances in which the parents may have been placed. The longer the time during which any peculiarity or defect of structure has existed, the greater the tendency, other circumstances equal, to its becoming permanent in the progeny.

The organization may be either *sufficient* or *deficient*. In the first case, the materials are sufficient in quantity, the several organs are properly balanced amongst themselves, and the quality, or temper, of the vital machinery is normal. All these are the result of the sufficient and proper action of the generative forces of the parents. 2ndly, the organization may be deficient—deficient in either of the three essentials just mentioned, or in all of them.

Again: As no display of vital energy (or life) can take place unless the organized body be acted upon by the powers of nature which we call vital stimuli, the next factor in the production of health or disease will be found in the action of one or other of these powers. They are, Air, Light, Heat, Food, Physical Motion. It is to the operation of these agents, singly or collectively, upon the organized body, and to these alone, that all the varied actions of living beings are attributable; and in the case of most animals, and especially of man, each one of them is of the primest necessity.

When so delicate a structure as the human body is submitted to tho operation of these physical agents, so powerful for evil as well as for good, it may be supposed that every possible variety in the vital motions thence resulting will be displayed. Excess, defect, or nice adjustment, here play a more important part in affecting health, than they do in the construction of the organism itself. The forces employed to drive the machinery require more care in

application than is necessary, or even possible to be taken, in the securing of a good constitution of the machine itself. The latter we have to take as we find it; the former are placed by Providence very much under our own control; *and it is upon their proper use, or abuse, that all of health, taken individually, which we have it in our power to influence, depends.*

Health, then, is a variable condition of existence; which, whilst we may define it to be the normal condition of every organ of the body, and the perfect operation of its functions, must be modified and conditionated (to use a scientific barbarism) in the case of every separate individual. Not only is the term a relative one as applied to different persons, but one of variable interpretation even when used of the same person at different times, and at different periods of his existence.

To enable the reader the better to understand what follows, I shall here give a concise recapitulation of the chief functions of the body, taken in an order consecutive to their importance, pointing out their relations with, and natural dependence upon each other.

NATURE OF LIFE.

The question, "What is Life?" has been asked ever since man acquired sufficient mastery over rude nature to secure to himself leisure for the cultivation of his speculative and reflective faculties, and began to look upon the wide expanse of the universe with other eyes than those necessary for the selection of his daily food and raiment. The consciousness of the operation of his own volition, and of his intellectual and emotional faculties, must have induced speculation as to the powers whence such phenomena were derived. Man must early have looked upon him-

self as apart from, whilst forming a part of, the general economy of nature. The operation of external nature, its various forces and phenomena, would receive from him a solution partaking of the character of the ideas which, in the microcosm of the individual man, would have been formed from the bent of his own faculties. Thus, himself a *person*, a self-conscious and originating power, he would endow the natural world of effects with all the personality and efficiency of action which belong only to independent powers. Every great element of nature was believed to possess, or rather to be possessed by, an *archæus*,—a soul—whose office it was, under the guidance of the universal and supreme ARCHÆUS of all, to regulate and to bound all the motions of physical bodies. When the winds, the sea, and the air were believed to be animated by free agents, no wonder that the phenomena of animal and vegetable life were supposed to represent the operations of beings of at least an equally intelligent order. Thus the gods and goddesses—the genii, or intelligences of living action—represented even in the late ages of Grecian and Roman civilization by Ceres, Pomona, Flora, and the rest, were nothing more than the impersonation of these several independent principles, without which no idea could be formed, in the ancient mind, of the cause of phenomena so various, and so evidently the result of order and law. In accordance with this view, we find that the great fault of philosophers of early times, and of those in particular who made the operations of plants and animals their study, was a confusion of cause and effect; and, above all, an insufficient and often ridiculous estimate of the powers of natural agents. The archæus, or the vital principle, was sufficient for all difficulties, and in the mode of its operation was now elevated to the dignity of a minor deity, now depressed to the level of a blind

and unconscious servant of organization. These grave errors prevailed amongst the students of nature down to very recent times. For, although the re-introduction of the inductive philosophy struck at the root of these, as of all other errors in the method of interpreting nature, it could operate only on the minds of those whose faculties had been disciplined for its reception. The glory of the Baconian philosophy consists in this—that it expands with the expansion of the human mind, and, like the composition, of the greatest musical geniuses, displays higher powers, and exhibits new graces, the more it is subjected to the tension of modern development.

The notion of a vital principle—that is, of an entity *independent* of the material organisms, regulating their nutrition and preserving them from decay, acting sometimes even against the known laws of chemistry—has been slowly, but now finally, abandoned by all physiologists of repute.

The result of this liberation of the intellect from the merely imaginative conclusions of the ancients, and from the fanciful ideas which they entertained of the resemblance of the efficient forces of nature to the self-acting and independent human soul, has been that a body of facts and inferences, deduced from close observation and experiment, has been built up, which, so far as it goes, is unassailable by any powers of the human mind. The structure, composition, and general functions of the several organs of animal bodies are now placed upon a basis of truth arrived at by experiment and pure induction. Changes may, and certainly will have to be made in our estimate of the relative forces either acting upon, or operating from, the several organs; but none, we may confidently predict, will ever have to be made as regards our certainty, either of the final cause and intention of their operations, or of the main purpose which

they severally serve in the general economy. The study of the effects of natural agents, too, in all their diverse operation upon the animal world, has followed the same course; and, at this day, no effect will be credited to any of these forces which has not been verified by reiterated and independent confirmatory experiment.

All the phenomena of life, then, we assume to result from the action of *external natural powers* upon an *organized structure.* To these natural powers we give the name of *vital stimuli*, because the organized frame is inert and immobile until stimulated to action by the impact of one or more of them upon some part of its mechanism. The result of such mutual contact is vital action, or vital motion—the phenomena of life. Nothing more is wanting to complete the circle; no archæus, no vital principle, whether intelligent or instinctive. In the case of man alone do we find any traces of a second entity—a soul—and that, so far as *science* can show, not independent of some kind of bodily organization, but an additional element, surmounting, and, as it were, perfecting those intellectual and emotional qualities which are shared with us by the brutes. The divine afflatus breathed into man's nostrils by the Creator, gives him alone, we must suppose, of all terrestrial creatures, a capacity to enjoy other scenes, and to be affected by another world than that natural one which bounds and restrains all other living beings besides.

The relation which the apprehension of this great physiological truth bears to the daily care of our health and the means of resisting disease will be perceived when we reflect upon the very diverse effects which must result from the action of the same natural powers upon constitutions of diverse kinds. No two constitutions are exactly alike, and the actions of the natural powers—air, light, heat, food, &c.—

instead of representing a definite amount of force, are in practice found to act upon it with every degree of variation. The divergencies from a common action caused by our various civilization, by our intellectual and moral culture, by the power of will and desire, tend most materially to vary and diversify the vital processes which result from the contact of nature with the living organism. To say that such and such air and climate, such and such food or clothing, will be productive of health, or the reverse, without first defining the character of the bodily frame and temperament, is like a sailor declaring the wind to be favourable without knowing to what port the vessel is bound.

VITAL FUNCTIONS.

Regarding the human frame for the present from one point of view only—viz., the effect of natural agents upon it—a sketch of the principal functions which result from the operation of those agents will be desirable.

RESPIRATION, AND CIRCULATION OF BLOOD.

The circulation of some kind of nutritive fluid seems to be essential to all life, except perhaps that of some of the very lowest organized beings. At the moment of entering the world, the human fœtus suffers a death and a new birth. The moment the young is separated from the parent, all means of sustaining intra-uterine life are cut off, and, without the immediate aid of one of the natural stimuli, no fresh life could be initiated. *Air*, acting upon the nerves of the face and skin, causes, by reflex action, an inspiratory effort, and thus the first link in the great chain of life is forged. The blood, previously collected in the lungs, receives oxygen; and now, more highly vitalized, rushes to the heart to maintain independently

that circulation which before was simply maternal—dependent upon the force of the mother's heart. The living tissues of the young animal are now no longer to be built up from the mother's blood. They draw upon the resources of its own circulation, and the vacuum thus caused in the vessels must be supplied by food which its own stomach must digest and convert into blood. Two great factors are here introduced—viz., *air* to vitalize the blood, and *food* to supply its pabulum.

Indeed, we may compare the animal frame to a plain which is supplied with two great systems of irrigation. Two main canals permeate the body in every direction. Beginning with the mouth and nostrils, air enters a tube—the windpipe—which conveys it to the lungs. The lungs are expansions of this tube into two sponge-like bodies, into every minute mesh and cell of which the air penetrates. Here, in the most delicate vessels, called, from their slender calibre, capillaries, the air first meets with the blood; and the interchange of gases which there takes place is the first of the efficient causes of the circulation of that fluid. Oxygenated, vitalized, or by whatever term we may designate the change which has just taken place in the blood, it is now, and now only, fit to return to the heart. This it does, not by the way it came, nor to the same side of that organ, but by another set of vessels, to its *left* side. Here it comes in contact with the most powerful muscle or structure of the body, the walls of the left ventricle of the heart. This cavity is lined by a most delicate membrane, and it is upon it that the first impression of the newly oxygenated blood is made. Action takes place. Stimulated by the contact of fresh blood, tho muscular walls of the ventricle contract with force sufficient to drive the blood to the remotest corners of the frame; and assisted by the

tone and elasticity of the arteries, it makes the circuit of the whole body. A short period of rest follows this effort, during which there is no pulse. Then, the natural elasticity of the heart's fibre causes it to expand and suck in from the lungs a fresh portion of new blood, to be again propelled through the circuit of the body as before. Before returning to the heart, however, the great purpose for which the blood circulates has to be effected—viz., the nutrition of the tissues.

NUTRITION.

No sooner has the blood started on its course along the great vessels, than the main channel becomes lessened at every step by the branching off of side vessels which go straight to important organs, dividing again and again as they proceed. Each branch is subdivided into capillary vessels, which form that wonderful network in which the vessels are so minutely and closely interwoven that a pin's point cannot anywhere be introduced without wounding one or more of them.

Out of these small capillary vessels certain component parts of the blood are withdrawn by each tissue as it passes. The passage of these materials from the blood through the walls of the vessels is effected for the purpose of replenishing that waste which is constantly going on in the tissues by use. No action of the body, probably, ever takes place without a greater or less portion of tissue being, by that action, killed—rendered unfit for the performance of vital motion—and therefore fit only to be cast out of the body as effete matter. Whilst rendering up to the animal tissues this new nutritive material, the bloodvessels must receive at the same time the worn-out matter, which, as just stated, is no longer fit to remain a component part of

the organism. These operations of the process of nutrition are conducted in a manner incognisable by the senses; they involve the most recondite chemical changes; but they are nevertheless under the dominion of those known physical laws which govern the interchange of all gaseous and fluid bodies. In order to come within the powers of this constructive and destructive force, all the materials must be rendered fluid.

If it be asked, by the exercise of what force this passage of material through the vessels to replenish the tissues, and *vice versâ*, for removing old and effete matter, is effected, it can only be answered, by that of a *vital elective affinity*—an attraction between substances of the same nature, a power of growth which adds bone to bone, muscle to muscle, sinew to sinew, and nerve to nerve; and which occupies the same relative position in the animal economy as chemical affinity does in the physical world. There can be no nearer definition given of it than this; for it cannot be seen in operation, and can only be judged of by its effects. Nutrition is *vital* growth, just as the aggregation of crystals is *chemical* growth, and the cohesion of particles of lime from dropping water, forming a mass of stone, is *physical* growth. At this point of the circulation, we are brought face to face with the very arcana of life;—the building-up of tissues capable of various offices, when acted upon by their appropriate stimuli.

Let us now follow the effete or worn-out matter absorbed into the bloodvessels to its destination. The animal organism is not more tolerant of the incoming of fresh material to promote its action, than intolerant of that which has lost its virtue by use. The casting out of effete tissue is effected by means of machinery quite as elaborate and complicated as that which is provided for the circulation of arterial blood. Reabsorbed into the torrent of the

circulation as it passes by every tissue, the worn-out matter is carried to organs specially provided for its elimination. These are the skin, the kidneys, and the lungs. At the kidneys, a most minute and delicate system of vessels is provided for again receiving most of the animal and saline matter which has become unnecessary, and even poisonous, to the system. At the skin, a large quantity of water is thrown out, carrying along with it saline, fatty, and other animal matter. The lungs are the great outlet for the carbonic acid and other noxious gases which are formed by the oxidation of the tissues, and also for watery vapour.

The blood having thus deposited its rich burden of nutritive material at every halting-place in the body, and so replenished the wasted tissues, and purified itself to a certain extent by the elimination of deleterious matter at the several emunctorial organs, now returns, by means of the venous system, straight to the right cavities of the heart. By their contraction, synchronous with that of the left side, it is sent to the lungs to fetch-in a fresh burden of oxygen, and then to go the same round of the body as before. In this way is completed the great primary circulation of the blood, of new and of old material, for the nourishment and purifying of the tissues.

DIGESTION.

To supply the daily and hourly waste which the nutrition of the body, in the manner just described, occasions in the blood, fresh material, in the shape of food, must be introduced. In a different manner, and by a totally distinct set of vessels, this food circulates through the body, constituting what may in some sense be called the *second* circulation. Beginning at the mouth, the throat, gullet, stomach, and intestines form one long uninterrupted canal,

through the whole length of which an indigestible substance—like metallic mercury, for instance—may pass without having really entered the body at all. In the healthy state, however, nothing which can form pabulum for the blood is allowed to pass along the whole length of this canal without being subjected to those changes which constitute what is called digestion. Digestion is a disintegration of the molecules of organized substances into sundry chemical elements. It is begun by the comminution of the mass of food by the teeth, followed by its admixture with the saliva and other juices of the mouth. The food is then passed along the gullet into the stomach, where the next and greatest change awaits it. The stomach must not be looked upon as a mere expansion of the gullet, for the purpose of retaining the food in it until it has been acted upon by the gastric juice, as is popularly supposed. It is an entirely separate organ, acting upon a different principle to that of every other portion of the alimentary canal. In it the food is subjected to a continuous churning backwards and forwards along its inner surface, by which the semi-fluid mass of food is brought into contact with every portion of the surface of the organ. The gastric juice, which is continually poured out during the process of digestion, is, by that means, intimately blended with the food, upon which it immediately begins to exert its solvent action, and so continues to do until the food is in a proper state to be passed on to the next portion of the tube—the small intestines.

After a stay of from one to three or four hours in the cavity of the stomach, the chyme—partially digested food—enters the first portion of the bowels, called the duodenum, where further changes, not necessary to be here described minutely, are effected in its condition. Some of the more fluid parts of

the food, and most drinks, enter the circulation directly by absorption from the stomach, readily passing through the walls of its numerous and large vessels. The remainder, after reaching the small intestines, and being mixed with the bile and other juices there present, is taken up by a special set of vessels, which terminate in the thoracic duct. This duct or vessel conveys it to one of the large veins near the heart, to be there mixed with the current of the blood, and sent, with the rest, to the lungs for due oxygenation. In this way is completed the second circulation, that of material for the *formation* of blood from the food. The last portion of the food which was received into the intestines, and which is either incapable of being digested, or which the stomach, either from the deficiency of power, or from repletion, refuses to deal with, is passed on into the large intestines, from which it ultimately escapes from the body.

These two circulations, in which are embraced all the nutritive functions of the body, may be compared to the course of a noble river, carrying on its bosom valuable merchandize of every description. Along its banks a dense population receive, at every step of its passage, such things as they require; and at the same time cast into it, as the Hindoos commit the dead bodies of their friends to the bosom of the Ganges, their refuse and used-up materials. Those who reside at a distance from the main current are supplied by means of branch canals, where the same operations take place. The whole is kept supplied with fresh goods from a reservoir (the stomach), which, though at a distance from the river course, has numerous and intimate connexions with it.

In these few pages I have endeavoured to sketch cursorily, but as plainly as possible, the manner in which the great vital functions of Respiration of Air,

Circulation of Blood, Secretion, Excretion of effete matter, Digestion of food, and the assimilation of its nutritive parts with the tissues of the body, are severally effected; and how they are intimately and inseparably connected together, and inter-dependent.

NERVOUS SYSTEM.

There is now only wanting to complete the self-sustaining operations of the vital force, the action of some power whose office it shall be to regulate and co-ordinate the operations of all the other functions into harmonious union. This power resides in the nervous system. In all the higher-class animals the nervous system is of a very complex order, and is endowed with diverse powers, all of them co-ordinated to the well-being of the individual, whilst by means of some internal perception it becomes acquainted with the wants of the body, and all that is necessary to be felt in the condition of its organs; by the general action of sensation and perception, it takes knowledge of impressions from without which instinct associates with its self-preservation. The nervous system, like the circulation, subserves two great objects, and possesses two different structures, for the purpose of effecting them. The principal portion is composed of the Cerebrum, or Brain proper, and the spinal cord, which unites the brain above with all the various nerves of sensation and motion in the body below. The nerves arising from the whole length of this cord (and some which are given out within the head itself, to be distributed to the organs of sense) have two functions. The one is to carry sensations *to* the brain from the whole surface of the skin, and the other to convey motive power *from* the brain to the limbs, in obedience to the mandates of the will or the requirements of instinct. The cerebrum, or brain proper, may be compared to a

head office, to which all information is sent in order to be sifted, classified, and arranged, according to its bearings upon the well-being of the State: and from which all orders, resulting from reflection and judgment upon the information received, are sent to the several departments.

The second and smaller portion of the nervous apparatus is called the sympathetic or ganglionic system; and its office is to preside over the proper performance of the various organic or vegetative functions—such as circulation, digestion, &c.—and to bring these into harmonious relation with each other. When one organ becomes partially incapacitated, the sympathetic calls upon another to perform duties, not similar indeed, but vicarious to those of the invalid organ, thus enabling life to be carried on until the effort of the curative force of nature, or the skill of the physician, shall have restored the weak member to healthy action. The sympathetic nerve is also connected by numerous links to the cerebro-spinal system, so as to make the mind acquainted, by a feeling of uneasiness or of pain, with anything abnormal in any of the vital organs.

SUMMARY OF VITAL FUNCTIONS, OR LIFE.

All the various functions of animal bodies may be comprised under two great classes or heads, viz.—Those which relate to the well-being of the individual, and those which tend to perpetuate the species. The first, or those which effect the preservation of the individual during its allotted span of existence, are of two orders—viz., the *Nutritive*, which term, taken in its widest sense, embraces Respiration, Circulation, Digestion, Secretion, and Excretion; and, secondly, the functions of *Relation*. This term was introduced by Bichât to designate all those means by which we communicate with the world without us, for the

purpose of procuring food and administering to our passions and desires. The senses of sight, hearing, smell, taste, and feeling, are the special servants of this function, and they all contribute indirectly to the other order, or nutritive functions.

The second class of functions subserves all the generative forces, and the bearing and rearing of young. Next to the great law of self-preservation, nature places that which provides for the continuance of the species, for the succession of individuals of the same nature, to fill up the vacuum caused by the all-pervading operation of death. This is generation.

TEMPERAMENT.

This sketch of the phenomena of life, as they are represented in the higher mammalia and in man, will serve as a foundation upon which to rest some remarks upon what are called TEMPERAMENT, HABIT, and PREDISPOSITION, as modifying the action of natural agents upon the constitution, and so producing those natural varieties in the bodily health and mental character which are constantly met with in individuals.

Four different kinds of temperament have been generally noted—viz., the Sanguine, the Phlegmatic or Lymphatic, the Bilious, and the Nervous. To these some writers add a fifth, composed of the intermixture of the characters of some two or more of the rest, which they call the *Mixed* temperament. These names have been given to denote the predominance of certain elements of the function of life over others; so that without absolute defect or disease, some of the vital functions are thrown into comparative shade, whilst others stand out in bold relief from the rest; and these variations are sufficiently definite to convey to the mind a tolerably correct notion of the prevailing or dominant function.

The *Sanguine temperament* embraces features of a

florid or ruddy complexion, tolerably full and rounded contour of body, blue or grey eyes, and light-brown, auburn, or red hair. The circulation and respiration in these persons is full and active, their digestion generally good, and their character is hopeful, energetic, and somewhat self-sufficient, with a large amount of power both of body and mind. There is, however, in the sanguine a certain impressibility by disease; they are, perhaps, more readily affected by changes of condition of life, by noxious agents, including epidemics; and disease seems to take great hold of and to commit much havoc among them. To this defective power of resistance to adverse physical causes must be added a want of stability of character, evinced in deficient persistence and steadiness of purpose. The temper is often hasty, though forgiving, and entirely free from sulkiness (which latter quality argues a good deal of persistence and determination of character); the disposition is volatile, and there is a tendency to engage in a variety of objects, whether of study, amusement, or business. Hence, persons of the sanguine temperament are in the habit of having "too many irons in the fire" at one time, the ill effects of which, however, are often obviated, and the difficulties surmounted, by the high spirits and ardent application which are due, in a great measure, to excellence of the digestion and to the general vigour of all the nutritive functions. Women of this class present, perhaps, some of the most charming qualities which can endear them to mankind —trustful, innocent, devoted, cheerful in disposition, whilst the bodily frame is characterized by a rounded and graceful contour, a fair amount of embonpoint, and complexion clear, and often dazzlingly fair. These qualities of mind and body, harmoniously blended, produce the very beau-ideal of female beauty; and, if intermixed, as they often are, with a slight degree of

the nervous temperament, giving delicacy and refinement to the expression, and sensibility to the mind, form a combination of qualities productive of the happiest and noblest effects.

The sanguine temperament, as a national characteristic, may be said to belong almost exclusively to the inhabitants of the northern temperate zone in Europe. Tacitus speaks of the red hair of the Germans, and the Danes and Anglo-Saxons had hair in which different shades of red generally predominated. It appears, however, from the large admixture of dark hair and swarthy complexion in the descendants of all these races, either that the observations of the Romans were too general, or else that with the red-haired races have been largely intermingled tribes bearing the characters of the nervous and bilious temperaments.

The next temperament—the *Phlegmatic* or *Lymphatic*, so named by the ancients from a supposed excess of fluid in the organism—appears to be a degenerate and low type of the sanguine. The red or auburn hair is exchanged for flaxen or sandy; the eyelashes are light; the eyes grey, or light-blue; the complexion often very fair, inclining to dull or muddy white. The skin is very delicate, and readily tans and freckles by exposure to the sun. Persons of this temperament are generally large, of full habit of body, and slow in their movements; and their passions, though readily enough excited, are evanescent, and quickly subside. Intellectually, such persons seldom distinguish themselves. There is a torpor and sluggishness of circulation which seems to deprive the nervous system of sufficient pabulum to enable it to sustain any long-continued effort. This temperament has been said to prevail chiefly amongst the Dutch, and, to some extent, amongst the Germans, as well as amongst ourselves. However, as it is not com-

plimentary to any race of people to set them down as endowed with a low type of organization and of character, I will not affirm that there is much truth in the observation.

The third variety of temperament is the *Bilious*. The term is correctly applied, according to Mr. Mayo,* in consequence of the "redundancy of bile in the system." I suspect, however, that this statement must be taken with great caution. Indeed, it is doubtful if this temperament bears any more real relation to the actual condition of the biliary apparatus than the lymphatic bears to any ascertained redundancy of such fluid in the body. In fact, the peculiarities of temperament have so much in common with certain mental characteristics, that an enumeration of those of the body gives only half expression to what is desired to be conveyed to the mind. The bilious temperament, taken with the qualification of the term named above, possesses very distinct characteristics. It is, in most respects, the very opposite of the sanguine, and evinces a preponderance of other functions than that of the circulation. If all persons were divided into two classes, the fair and the dark, the sanguine temperament would be the type of the one, and the bilious of the other. This opposition extends to the mental as well as to the bodily characteristics; and, just as the sanguine degenerates into the lymphatic, so the bilious temperament occasionally descends to the melancholic.

The prevailing characteristics of the bilious temperament, as regards the body, are a somewhat spare, though often large, and moderately full frame; the joints are large and prominent, the figure angular, the features well marked, sometimes coarse, the cheekbones high, and the countenance expressive of deter-

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* "Philosophy of Living," 1837.

mination and force of character. The hair is generally black and coarse; the eyes hazel or brown, sometimes grey; the lips thick, and the jaws firm and strong. There is a moderately full circulation; and, altogether, the frame evinces power, and a high degree of resistance to noxious and debilitating agencies. The characteristics of the mind are firmness, degenerating into obstinacy; great tenacity of purpose and attachment; devotion to one or to few objects of interest, whether of business or affection. Judgments are formed slowly, and after much deliberation, and, when arrived at, are not easily shaken or changed. Prejudices follow the direction of principles, and are adhered to with equal tenacity.

If we are to advert to the peculiarities of this temperament as modified by the female sex, we shall meet with some difficulties. It would appear that women of dark complexion, in this country at least, should be divided into two distinct varieties—the one partaking of the firmness and angularity of frame and hardness of character which distinguish the true bilious temperament—the class of "strong-minded women"—the other possessing, with their dark hair and pale complexion, many of the qualities which characterize the nervous temperament.

Without dwelling unnecessarily upon the less inviting type of the dark-haired race of women, it may be stated that their large and powerful frames, plain features, black eyes, and coarse, strong hair, are properly associated with much vigour of mind and strength of the passions, the gratification of which is not always restrained with very great scrupulosity of conscience, nor softened by too much sensibility of character.

The slighter and more delicate form and gentle demeanour of the majority of dark-complexioned females separate them as widely from the above as

the sanguine are removed from the lymphatic; and the soft melancholy of their character, which often prevails, possesses a charm for many minds not inferior to that of their fairer sisters. Possibly the melancholic tendency and taciturn habit of mind are the result of a certain deficiency of power in the circulation, which is not natural to the true bilious temperament; and the character may lose somewhat of its force, and the feelings acquire their impressionability, from the natural delicacy of the female organization. Be this as it may, it is found, in practice, that a slight figure, somewhat deficient in embonpoint, a complexion which, generally of a clear olive, sometimes partakes of marble paleness, soft hazel eyes, and smooth, black, and glossy hair, are by no means indicative of too much energy of character, but are generally accompanied by a docility of temper, sometimes passing into indolence, and a confiding constancy to the object of affection, perhaps not equalled in any other temperament.

The last of the four temperaments is the *Nervous.* This type has been more fortunate in the name attached to it than the bilious or lymphatic. It truly designates a constitution of bodily and mental frame in which the nervous and intellectual elements predominate over the rest of the functions, forming a character as admirable for its intellectual strength and acumen, and for its lofty flights of imagination, as it is disfigured by the impetuous and frequently unruly bent of its more animal passions. In this temperament the bodily frame is often very slender and delicate; the hands and feet small, the features of almost effeminate delicacy; the complexion either pale or delicately tinted with pink. The eyes are quick, large, and lustrous; the type of the head round, and generally well balanced.

To this favoured class belong most that are endowed

by nature with a great degree of the higher and more subtle of the intellectual powers. Wit, and critical acumen, with sparkling fancy, are theirs; whilst they possess a facility of acquiring knowledge and of apprehending the obscure and intricate bearings of difficult problems in physical, but more especially in moral, science, which distances all competitors. These are the men who consume their physical energies by the midnight lamp, whether in the literary garret, the editor's sanctum, or the public office. When the passions of these men are let loose, and the moral consciousness which should subject them to reason is laid asleep, or drugged by poisonous sophisms, then it often comes to pass that intellect, fair fame, self-respect, life itself, are immolated on the altar of licentious indulgence, which is rendered all the more fascinating by the cunning and clever contrivances which the acuteness of the perceptions and the ability of the enslaved intellect bring to bear upon its gratification.

In the female this temperament follows very much the same direction as in the male. There is the same delicacy of organization, quickness of imagination, and fervour of the emotions. Well is it for these interesting characters when born in a rank of society which places firm but necessary checks upon female vivacity, and when tender and gentle moral training elicits those higher powers which alone can guard the unsuspecting pliancy of youth from the dangers which beset a too facile disposition.

We have spoken of a *fifth* temperament, which has been called the *Mixed.* In admitting this, however, to rank with the other four, it must be borne in mind that few instances are to be met with in which any of the temperaments exhibit themselves in the purity which the foregoing typical descriptions would lead one to expect. Mixtures of two, or even more

of them in the same individual are the general rule, with some one more dominant than the others. Thus, the sanguine temperament is but seldom found unblended with a slight dash of bilious or nervous type; and the bilious becomes intensified into the melancholic, or mitigated by admixture with the nervous.

These differences in temperament may be looked upon from another point of view. A French writer has pointed out a distinction existing in the general development of the bodily organs, as owing to the predominance over the others of one of three great cavities:—viz., the head, the chest, and the abdomen. To those persons who have the head large, and the features generally well pronounced, he assigns the term *Cephalic*, or *Cerebral* development. In the second case 'the chest is unusually broad and expanded, the shoulders widely separated, and the arms and hands large, sinewy' and powerful. These are said to have the *Thoracic*, or *Pectoral* development. The third class are distinguished by a full and often protuberant stomach, much fat, or flesh, and large hips and lower extremities. To this peculiarity he gives the name of *Abdominal*, or *Gastric* development.

No doubt these characteristics are natural; and they agree, in some measure, with the older division into temperaments. Thus, the cerebral development is generally met with in the sanguine, and in the mixture of that with the nervous element. It is true that the size of an organ is not, *per se*, to be taken as any measure of its activity, or quantity of Emotion; nevertheless, a well-developed organ, receiving a large quantity of blood, and endowed with a large nervous apparatus, will, *cæteris paribus*, excel in vigour of action those which are more sparingly supplied.

The broad chest and well-set shoulders denote increased room for the action of the heart and the expansion of the lungs. Hence, such people are capable of the greatest physical exertion, muscular power depending chiefly on the capacity of the chest. Workers in iron, shipbuilders, brewers, millers, and others whose occupations call the muscles of the chest into increased action, generally exhibit the finest specimens of the thoracic development. The abdomen is generally large and protruding in very fat persons—in women more than in men, and in persons of a slow circulation and torpid intellect. This corresponds with the phlegmatic or lymphatic temperament. Such persons are often great eaters, and their digestion is active and complete notwithstanding that they take little exercise, and undergo no exertion capable of reducing the bodily powers. To women this formation is natural, and is intimately connected with that activity of the nutritive and reproductive functions which is a necessary attendant upon their sex. In men the tendency is to disease of the digestive apparatus:—from overactivity; to become excessively fat; to debility of the circulating and muscular systems; and such persons are easily prostrated by disease, or any unwonted call upon their bodily powers.

The differences which exist amongst persons as regards temperament, inasmuch as they represent real variations in the organization, present one factor of the quality of health produced by the action of a given amount of natural stimuli. The minute varieties and combinations of these different temperaments, in every conceivable degree of admixture, render it impossible for any one to lay down absolute rules for the guidance of others in the use of those elements which are necessary to life and health. It is here that personal experience comes to our aid;

and the saying that "every man is either a fool or a physician at forty" gives a measure of the time required for estimating the various effects of vital stimuli upon the individual organism at their just value. The appropriate place for marking the exceptions to the *general* rule will be that in which the special action of the elements of nature upon the human frame is described. All that need be said here is, that generally, each temperament is most advantageously situated when surrounding circumstances *fall in with, rather than oppose*, the natural bent of the bodily and mental disposition which accompanies it. Thus, the sanguine man requires for the full play of his powers an active and, generally, out-door occupation, in which some variety occurs. He is well able to brave the vicissitudes of weather, and bears cold better than those of any other temperament. His food should be tolerably rich and succulent, whilst stimulating drinks should be used sparingly. Persons of this temperament are those whom teetotalism appears to suit best. The absence of fermented drinks is made up to them by the ingestion of a large amount of food which their active habits enable them to dispose of. The quick perceptions and excitable brain of the sanguine man are chafed and irritated by the thousand and one petty obstacles to his progress which the bilious or phlegmatic temperament would receive with stoical self-restraint or stolid indifference. Herein is seen the essential difference between the two most typical temperaments. Whilst continued opposition, or want of success, makes the sanguine irascible, reckless, or misanthropical, the same fortune sinks the bilious into the inertia of settled melancholy.

But it is the nervous temperament, the favoured

child of genius, which most of all requires that the current circumstances by which he is borne along the stream of life should be in unison with the current of his desires, and favourable to the full play of his intellect. Opposition and disappointment, evincing an absence of that appreciation by others which constitutes the greater part of his happiness, lower his self-esteem, throw back his gushing sympathies upon himself, and unfavourably influence both his bodily and mental functions. An excessive amount of adverse circumstances leads persons of this sensitive temperament to revenge the denial of social appreciation upon society itself, by the abandonment of all worthy occupation, by the prostitution of the intellect and moral faculties to vicious pursuits, and, not seldom, by rashly terminating their miseries by suicide.

Health of body is more considerably influenced by the circumstances above enumerated than is generally supposed. The habitual ill-temper of the mind impresses, at last, the bodily functions with the corresponding unhealthy bent, and permanent deterioration of structure follows.

Of Hereditary Predisposition it need only be said that the term is here applied to that peculiar condition of the organism which manifests itself by an inborn proclivity to certain disorders of the bodily or mental functions, whenever circumstances become favourable to their development. There may be no outward signs of such tendency; and it is only by careful study of the antecedents that we come to be able to predicate what physical circumstances may be suitable, or the reverse, to the individual constitution. No general classification of these predispositions can therefore be made.

Habit is generally considered as opposed to tem-

perament, as being a thing acquired, whilst the latter marks the bent of the original constitution. This is not, however, a valid distinction, because habit, though not shown at birth, grows out of the peculiarities of the organism as they develope themselves, and is frequently as little under control of the will as temperament itself.

CHAPTER II.

AIR.

SECT. I. *Respiration—Quantity of Air respired—Expiration—Final cause of respiration—Mechanism of respiration—Condition of the lungs—Their capacity—Means of increasing it—In boys and young girls—Improper length of school hours—Tight-lacing, the effects of.* SECT. II. *Composition of atmospheric air—Its impurities—Carbonic acid gas—Relation of digestion to respiration—Retention of carbonic acid in the blood—Animal matter.* SECT. III. *Ventilation—For children—For delicate persons—Fires in bed-rooms—Ventilation of bed-rooms—Of sitting-rooms—Of the houses of the poor—Of public buildings.* SECT. IV. *Effects of the atmosphere of certain localities on the constitution—Atmosphere of towns—Of country districts—Mountain air—To whom useful—Noxious emanations in the country—Decaying vegetable matter.* SECT. V. *Winds—Cold and moist winds, their deleterious character—Frost—Cold and dry winds—East winds—Causes of their insalubrity—Precautions against them—Warm and moist winds—Warm and dry winds—Their great salubrity—Electrical state of the atmosphere.*

AIR NECESSARY TO ALL LIFE.

OF the four or five natural agents, or vital stimuli, which, operating upon the organized body, excite its functions to healthy activity, it would be puerile to name one as pre-eminently necessary to life, when that term is taken to express the sum of their united action. Air, temperature, light, food, motion, all are essential to life and health; and if we take the *air* first, it is only for the sake of physiological arrange-

ment, and because respiration is the function upon which all the others more immediately depend. The first stimulus which enters the frame of the new-born animal is atmospheric air. Few persons reflect upon the vital importance of our atmosphere—a sea of air surrounding every living thing. No life can endure without the free entrance of air, or its oxygen, into the tissues; for all land animals, except perhaps those of the very lowest organization, not only require to breathe by lungs, or other equivalent organs, but their bodies also must be freely immersed in a bath of air. If we remeve the hair from a rabbit or a rat, and then varnish the skin, so as to make it impervious to the atmosphere, death will result, although air be freely admitted to the lungs.* There is a constant passage of elastie fluids through moistened membrane like the skin; and even trees exhibit somewhat of the same requirement in this respect, and are often killed when their boles are covered in by earth to any great extent. The force of this fact, as regards the respiration of animals through the skin, may readily be felt by covering the face with moist plaster of Paris, as when a cast of the features is desired to be made. When the last pateh is laid on, the feeling of suffocation becomes almost intolerable, although the nostrils, and even the lips, are left freely open to the air. The same sensation is felt when the body is suddenly

* The celebrated case of the child gilded with gold leaf by order of Pope Leo X. occurs to the memory. On some occasion of great solemnity this Pope caused a young child to be completely covered with gold leaf, closely applied to the skin, so as to represent, according to the idea of the age, the golden glory of an angel or seraph. In a few hours after contributing to this pageant of pride the child died; the cause being suffocation, from stopping the exhalation of the skin; although, in the ignorance of those days, the death was of course attributed to the anger of the Deity, and looked upon as a circumstance of evil omen.

immersed in water, although to a less degree, as water contains much air suspended in it.

To *breathe* the air then is not enough. The whole of the body must be surrounded by a floating bath of air, passing between the clothing and the skin, having free ingress and egress, provided for by the porosity of the materials of clothing and looseness of the garments. What so miserable as a shirt wet with perspiration sticking to the body, or the *first* application of the hydropathic wet sheet? This vitally important condition of the surface of the body could not be secured, as it is in almost every conceivable situation, were it not for the beautiful law of the diffusion of gases. This law provides that wherever two gases meet, a mutual interchange of particles shall take place between them. There is no repulsion the one of the other, nor is there any special attraction or *liking* of any one of them for another. The light and the heavy, the acrid and poisonous, the pleasant and innocuous, readily intermingle. Were it not for this beneficent arrangement, many parts of our towns, many beautiful country districts, where the air moves slowly, would be totally uninhabitable, and could not be approached without instant death. The permeating power of atmospheric air prevents any other gas from accumulating to an actually poisonous degree; but to effect this, no artificial barrier must be placed against its diffusion.

SECT. I. RESPIRATION.

To understand the paramount necessity for pure air, we must have clear ideas of the function of respiration. All organized creatures live by change—change of the particles of their bodies which are worn out, for fresh matter to replace them. Food supplies a large portion of this but that furnished

by the air which they breathe is not only infinitely more bulky, but probably even heavier, than the solid food assimilated. Respiration is a double function: it imbibes that which is equal to food—oxygen—by which all that enters the blood from the digestive organs is perfected and completed, and expels the carbonic acid resulting from the destruction of those portions of the body which are no longer fitted to maintain life. Every stroke of the heart impels a portion of blood into the spongy texture of the lungs, and every act of drawing in air—*inspiration*—brings its oxygen into contact with it. If the blood did not meet the air when it arrived at the lungs, it would go back to the heart very slowly, and soon cease to do so at all.

The quantity of air required to be inspired will depend upon the size, activity, and condition of the system; in a word, upon the amount of *life* going on in it; and the quantity that *will* be inspired will be regulated by the condition of the machinery concerned in the respiratory function, that is, by the freedom or difficulty with which the air gains access to the lungs.

But there is another part of the act of respiration to be taken into account; this is *expiration*. As nature will not have a vacuum, either in the animal frame or anywhere else, there must be as much gas returned from the lungs as enters there. Carbonic acid gas and watery vapour are expelled by each act of expiration, and then there is a period of repose, after which the chest once more expands, to go again through the same process as that now described.

The final cause or purpose of respiration is to restore the blood to purity after it has become contaminated by having thrown into its current, during its circuit round the body, all the refuse and

worn-out atoms of the materials of bone, muscle, nerve, and other tissue, which have served the purpose of the organism and are now become devitalized—ready to perish. Not that the blood carries these substances to the lungs to be got rid of; but the oxygen respired is used to form them into other chemical compounds, and to adapt them for becoming the subject of secretion and excretion, chiefly at the kidneys and skin. The blood, so deprived of oxygen, and carrying with it the carbonic acid generated in the processes now mentioned, returns by the veins to the right heart, and thence to the lungs for renewal.

The *mechanism of the respiration* is beautifully adapted to all ages and conditions of the system. No matter what amount of food be taken, it cannot be made available to give flesh and strength until it has undergone complete oxidation in the lungs by contact with atmospheric air. The persons who consume the largest amount of food in proportion to their size, are children. They have not only to maintain the composition of the body, but to make large and constant additions to it. Hence the activity and rapidity of respiration in young animals, and the rationale of their incessant mobility. Young children seldom remain passive for many minutes together, except when asleep.

Old persons present exactly the opposite conditions of the respiratory function. Their bodies are wasting instead of increasing, and their food is therefore less in quantity, and generally of a kind requiring a smaller degree of oxidation.

Mechanism of Respiration.—The cavity of the chest is filled by the lungs and their appendages, the heart and great vessels, and nerves. The ribs, the muscles which occupy the spaces between them being attached to a rib above and one below, with the external lining membrane, called the pleura, constitute

the framework by which the chest is alternately expanded and contracted. In ordinary circumstances inspiration is an involuntary process, entirely under the command of that portion of the brain whose office it is to preside over this and some other involuntary motions—the medulla oblongata, or cranial portion of the spinal marrow. When air is required, the nervous force derived from this portion of the brain excites the contraction of those muscles of the chest which are adapted to elevate and expand the ribs, the spine and shoulder-blades being used as fulcra. The large internal muscle which divides the cavity of the chest from the belly—the diaphragm or midriff—is at the same time depressed, and so causes the floor of the chest to descend, thereby giving additional room for air to enter the lungs. In this act of expansion, the weight and pressure of the atmosphere upon the surface of the body, which is not less than fifteen pounds to the square inch, has to be overcome. This would be impossible were it not for that law of physics which prevents a vacuum from being formed wherever the atmospheric air can gain admission. The chest being expanded by the act of inspiration, the air rushes in through the windpipe along the bronchial tubes into the air-cells of the lungs, and thus the pressure of the external air is balanced by that which has passed within. There is therefore no vacuum; if there were, such is the extreme delicacy of the lung-structure, that its fine meshes would be ruptured, and irreparable mischief done, by the rush of air into a really empty cavity. If we close the mouth and nostrils, and then try to expand the lungs, we shall find that we cannot do it; we cannot make a vacuum, owing to our inability to raise the weight of the column of air which presses upon the walls of the chest.

Expiration, or the return of the air from the lungs,

is not so complicated and vital an act as inspiration. The elasticity of the cartilages of the ribs, of the muscles which move them, and of the substance of the lungs themselves, tends, as soon as the inspiratory act ceases, to restore the chest to its former state. The lungs collapse, the ribs fall, and the diaphragm rises to the position which it occupied before being put upon the stretch. The foul air which had separated from the blood at the moment of oxygen being absorbed, is driven out of the lungs by this act, and respiration is completed.

The *quantity of air* drawn into the lungs at each ordinary inspiration, when the body is at rest, amounts probably to about one pint, or twenty cubic inches, in the average of persons. Females and persons of sedentary habits inspire a much smaller quantity than those who use more active exertion. It will depend also upon two conditions, the first of which is the *want* of oxygen in the system, and the second, the condition of the respiratory machinery.

As just stated, all the food taken into the stomach and there digested, must be exposed to the action of oxygen in the lungs before it becomes perfect blood. The merest tyro in physiology may draw from this fact the conclusion that food and respiration must correspond. The resident in towns, the sedentary, and the invalid, who cannot take much exercise, or expand their lungs to the full extent, must be content to eat less solids and to drink less fluids requiring oxygen for their combustion, than the more happily-circumstanced countryman, who not only breathes plenty of air all day, but also receives it in a state of purity.

Want of air is also much felt in many diseases in which the tissues of the body are wasted rapidly—as fevers, inflammations, and diseases of great nervous excitement; also after long-continued inactivity, as after sleep, lengthened study, or simple idleness.

Hence arises the want that is felt for exertion and fresh air in early morning, or after breakfast, and of some exercise before taking food, by those whose occupations compel them to a sedentary or constrained position the greater part of the day. The clerk, or office man, must have his walk to and from office, and before dinner, when he leaves at four or five o'clock. It is not well to retire to rest after an evening's reading, study, or writing, without a turn in the fresh air or a cool room, in order to give the lungs a little activity and infuse more oxygen into the blood before going to sleep. By this means that irritability or sleeplessness which results from over-tension of the nerve-force is avoided; and if supper has been taken, there is still more necessity for this slight amount of exercise. Here, again, is the rationale of the very old and familiar adage—"after supper walk a mile." Not *many* miles, but *one*, or its equivalent. All active exertion, both of the body and of the mind, requires the free admission of oxygen to the blood. But this portion of the subject will fall to be considered under the head of Exercise.

The other factor which regulates the entry of air into the lungs is the *condition of those organs themselves*, or of the walls of the chest which contains them. Let it not be supposed that the conditions of these organs and their effect upon the measure of the respiration, are beyond our own control, and therefore not fit subjects of discussion in a treatise on health. The form and capacity of the chest is, perhaps, next to the muscular system, that portion of our bodies which is *most* within our own power to improve and enlarge, or, by ill-management, to deteriorate and contract. It is a truth now sufficiently axiomatic as not to require to be dilated upon here—that all organs increase by use, within natural limits, and diminish and collapse by inaction. The brawny muscles of

the blacksmith, the shipwright, the sailor, and others who use great muscular exertion, testify to this common truth. So the muscles of the chest enlarge, thicken, and harden by calling them into frequent and moderately severe exercise. Gymnastics, boating, swimming, for the young of the male sex, and skipping and garden exercise for girls, tend to bring about a good development of the muscles of the chest. These once strengthened, their power of raising the bony walls of the chest is increased in proportion. The ribs are raised to a greater height, and by that means the column of air resting upon the chest is raised to a greater height, and more air rushes into the lungs to fill the enlarged space thus produced.

Thus, increased exertion of the muscles which move the walls of the chest, including the action of the arms and back, must *neccssarily* result in the entrance of a larger quantity of air into the lungs. The lungs are highly elastic, sponge-like bodies, and are capable of receiving a very much larger quantity of air when stretched only to a moderate extent than what is introduced in an ordinary quiet inspiration.

The *time for enlarging the capacity of the chest*, by exercising its muscles, is eminently the period of early youth. The ribs are, at that time, in great part cartilaginous and very elastic. By exercise their growth is greatly promoted and the elasticity of their movements increased. But even at a later age we need not despair of much improvement by judiciously calling the weaker portion of the apparatus into increased action. If the ribs have not become perfectly ossified, that is, the gristly portion converted into bone, gymnastic exercises, the use of the dumb-bells, rowing, or even swinging the arms well in walking, will be of great service.

If, however, the period of youth be allowed to pass by without a proper use of the muscles of the arms,

chest, and back, by means of which healthy respiration is alone effected, the cartilages of the ribs become ossified, their elasticity is for ever destroyed: the joints by which the ribs are attached to the spine lose their suppleness, and much exercise causes aching and pain in the back. A fixed amount of air only can *now* enter the lungs, and, by consequence, only a certain amount of bodily exertion is possible, without causing great difficulty of breathing, and perhaps fainting and exhaustion. This is the usual and every-day condition of thousands of young ladies whose mental education has been forced by prolonged confinement to the desk and schoolroom, and which the formal daily walk, in precise ranks of two and two, does absolutely *nothing* to remedy or alleviate.

On the other hand, there is an error of an equally fatal character which young men, especially those who are much devoted to study, and those who are confined to the desk for the greater part of the day, generally commit. They imagine that the best way of making up for the compulsory inaction of many hours each day is to take the most violent exercise in their power to accomplish, for a *short time*, at stated periods, perhaps not oftener than once a week. Nothing is more likely to defeat its object than such a proceeding as this. The muscles are sure to be over-fatigued, and are thus relaxed instead of braced; and, in the end, lose much of the contractile power they originally possessed. Permanent degeneration of the tissue of the muscles frequently results from sudden over-exertion, owing to the partial paralysis of their nerves, and the mistaken devotee of such practices often pays the penalty of his ignorance or folly by a life of painful debility and inertia.

Further observations on the management of the young in schools and colleges would be trite, though not trivial. No doubt but that the practice as to

corporeal exercises has very much improved within the last twenty years, and consequently we do not meet with so many sad cases of permanent distortion of the spine and other deformities, the result of constraint and inaction, as was the case when the following could be written :—"We lately visited, in a large town, a boarding-school containing forty girls, and we learnt on close and accurate inquiry, that there was *not one* of the girls who had been at the school two years, and the majority had been as long, that was not more or less crooked."*

This was written thirty years ago. At the present day, in all the best seminaries, what are called calisthenic exercises have been introduced; and what with dancing and "deportment," a good deal of bodily exercise is obtained. But the great vice of girls' schools and of many boys' schools also, is that the hours of study, at *one stretch*, are too long—much too long. The natural condition of the young of all animals is to alternate active exercise with repose, at *very short intervals*. Work and play, work and play, should be alternated several times, not once only, in the day. If a period must be fixed, I would say that *three hours* is the utmost that boys should be confined to the schoolroom at one time (two hours and a-half is much better), and much less, say *two hours*, for girls. This principle might even be extended with advantage to all the occupations of youth of a sedentary nature;—to students at college, clerks in public offices, apprentices to professions, &c. &c. Instead of seven or eight hours of uninterrupted work, with a few hours for relaxation in the evening, which, in winter, are but little available for active exertion, it would be much to the advantage of their health and tone of body and mind, if their labours were sus-

* The late Sir John, then Dr. Forbes, *Cyc. Pract. Med.*

pended once or twice in the course of the day, and a couple of hours given up to active exercise. All girls' schools, orphan asylums, and other places where female children are educated, should possess a large playground, where all sorts of romping games might be carried on, and, in wet weather, the same should be provided for under cover. If there be yet remaining any specimens of the class of female pedagogue who hold to the creed that young girls should never be *seen* in an ungraceful or *negligée* attitude, a high wall, or screen of some sort, might be had recourse to, in order to *save appearances.*

LIMIT TO THE AMOUNT OF RESPIRATION.

We are now brought to the conclusion, that there is a fixed amount of expansion of the chest and lungs, which, when the walls of that cavity are become rigid, and the muscles have acquired as high a degree of development as they are capable of, cannot be exceeded without danger of injury to the organs contained in it—the lungs, heart, and great vessels. This expansive force will vary very much in different individuals, whatever the actual capacity of the chest, from several causes; and this variation must be taken into account when we come to lay down general rules for exercise. The muscles of respiration are weakened by inaction in those persons who lead a sedentary life, and in females of the upper and middle classes. They are also unable to perform their accustomed amount of labour after fevers and other severe illnesses. In old people, they are frequently degenerated, and the muscular substance is replaced by fat. In all these cases, care must be taken not to exceed the *possible* in each individual case. Persons of the sanguine temperament can take and require a larger amount of respiration than those of the bilious and nervous tem-

perament. There is a difference in the nerve-force too. Some persons readily tire with any more than usual exertion in breathing; whilst the passions of fear and of anger influence the respiration unfavourably; the former in unduly diminishing, the latter in over-exciting the natural rate of breathing. If there exist any impediment to the free and regular flow of blood through the heart and lungs, as is the case in valvular diseases of the heart, chronic bronchitis, asthma, pulmonary consumption, and some other disorders, the greatest care must be taken to avoid any, however temporary, excess of exertion which may tend to hurry the breathing.

The form of the chest varies very considerably in different individuals consistently with health; and it is also much modified, and even distorted, by the artificial means adopted for the purpose of *improving* the proportions of the female figure. The introduction of the crinoline has worked at least *one* good. It has freed the legs from the trammels of the clinging garments, and so enabled its fair wearers to *step out* much better than they did before; thereby giving strength to the muscles of the lower extremities. It may be quietly effecting another change for the better in the female figure. The amplitude of covering now bestowed upon the hips, and downwards, admits of the waist being expanded beyond its former wasplike dimensions, without exceeding that conventional proportion to the rest of the form in which, ladies seem to persist in thinking, the true line of beauty is to be found.

Effects of Tight-lacing.—The fair sex has been read lectures to upon the iniquity of tight-lacing, *usque ad nauseam.* The pictures of horrors drawn by popular writers on the subject—the deformed chests, crooked spines, diseased hearts, consumptions, *et hoc genus omne*—one would suppose would long ago

have frightened the sinning fair out of their dearly-loved corsets. Every part of their tender nature has been appealed to, I fear in vain, to induce them to return to the free and unconstrained habit, not of uncivilized races alone, but of classic Greece and Rome. They have been told that they mistake the *beau-idéal* of beauty; that nature detests angularity, and delights in graceful rotundity and curved lines. To no purpose. The ladies reply that nature is not to be followed in matters of costume; otherwise, according to the dictum of the poet, female adornment might be dispensed with altogether. They have then been assured that the other sex do not really admire a very slender waist; all they require being a graceful shape and well-fitting dress. Still obdurate, they reply that they know better; and that, in their real heart of hearts, the gently tapering waist and spreading hips are admired by the gentlemen, probably because they present an easy resting-place for the encircling arm. Leaving, however, these lighter considerations, grave physiologists assure us that these deformed waists, though not exactly transmissible to the offspring, have for their effect defective devolopment of the internal organs, and weakened function thence resulting; that these are perpetuated in their children; and that hereditary diseases, like consumption, are kept up by such means in more fatal force. This kind of *argumentum ad feminam* might have some good effect if a knowledge of the functions of the human body were better understood by women in general. It is not yet, however, become fashionable to teach women that the health and constitution, power of resisting disease, vigour of body and healthy tone of mind, everything, in fact, that is derivable from parentage which their offspring shall enjoy, depend upon the manner in which they treat their bodies and exercise their

minds. It now becomes a *man's* question; and if women would have healthy men and women for sons and daughters, they must listen to the dictates of science and common sense upon so vitally important a matter as the conservation of their bodily organs in a condition to promote both their own health, and that of their descendants. Notwithstanding all this, the old adage remains true, "in medio tutissimus ibis." The same constraint which women constantly impose upon the lower portion of their chests would kill a man. It is true, however, that the form of their chest differs from ours, and the expansion takes place more in the upper portion than in the lower. If we watch the gentle heaving and falling of the bosom, even when the breathing is perfectly tranquil, and when there is no undue pressure upon the lower ribs, we shall see that this is so. To this fact it is probably owing that women have paid so little attention to the warnings and remonstrances just referred to. They have not themselves experienced *all* the inconveniences attributed to tight-lacing; and the sad consequences which have been threatened for their neglect of advice have not seemed to them to be a logical sequence of their habit in this respect.

I think this subject may be dismissed with a remark which the fair sex cannot well take amiss. It is that beauty of form certainly does consist in curved lines, and that an oval-shaped waist and moderately deep bust are *essential* to beauty; inasmuch as they fulfil the conditions which our ideas of fitness demand—viz., capacity for quiet and easy respiration; room for graceful, unconstrained motion; and lines which, in their incidence upon the outline of the rest of the figure, give nothing to offend the eye of taste. To contribute to this desirable effect, it is necessary that the corset be entirely free from steel or wood, and that it be of the slightest and most elastic make; that

the pressure be equal in all parts; and that perfect freedom from all pressure be secured to the bosom, so that it be neither compressed against the ribs below, nor unnaturally forced above its proper position. Such is the natural beauty of this part of the female form, compensating so often for plainness of feature, that, with these precautions, and care in seeing that the coverings superimposed on the stays lie smoothly and fit closely, the object so much desired, both by men and women, by the physician as well as by the connoisseur, will, in almost every instance, be obtained.

The capacity of the lungs varies much in different individuals. By this term is not meant the actual size of the organs, but the amount of air which, in their normal state, they are capable of receiving and applying to the oxidation of the blood. Mr. Hutchinson found that the vital capacity of the lungs in men of medium height, 5ft. 7in., was 225 cubic inches, or about 10 feet. This capacity increases by about eight cubic inches for every inch in height above 5ft. 7in., and diminishes in the same ratio in descending below that point. To enjoy the largest amount of breathing power, it is necessary to keep down the tendency to become fat; for it is found that when persons weigh more than eleven and a-half stones, the rate of increase of capacity according to height does not hold good, since it is lessened by one cubic inch for every pound that the weight exceeds that amount. The spirometer also proves that tall men cannot expand the chest so well, in proportion to their height, as shorter men.

SECT. II. COMPOSITION AND PROPERTIES OF ATMOSPHERIC AIR.

We have now, in the second place, to consider the various conditions of the atmosphere as affecting the process of respiration, and through it the health of the body.

It has been ascertained by chemists, that the composition of the atmosphere is everywhere the same—on the highest mountains, in the deepest valleys, on the bleak hills of Scotland or Norway, and in the burning plains of India. This is true also of the air in the most densely populated towns, as compared with that of the open country. Sanitarians who have investigated the causes of disease in our large towns, and come to the conclusion that the most fatal diseases are generated in, and propagated through, the medium of the foul air which so commonly prevails there, are staggered at this fact; and popular opinion certainly favours the notion that the air of cities cannot be identical in composition with that of the country. People say, "Let us get off into the country to breathe more oxygen;" the idea being that there is less of that gas in the air of towns than in that of country districts. The mistake lies, as usual, in not distinctly defining the terms. It is true that *pure* atmospheric air has the same composition wherever it is found: the proportions of nitrogen and oxygen are always the same to each other in air, as those of oxygen and hydrogen are in the case of water Chemists do not reckon impurities as component parts of the atmosphere, any more than they consider the foul drainage from towns, which pollutes the waters of our rivers, as forming part of the water itself.

Now the variations which are found to exist in the composition of the gaseous mass which surrounds us, are formed by *additions* to the real atmospheric *air;* and it is these additions, or impurities, which vary so much according to the locality from which the air is taken. All confusion will be easily avoided if the word *atmosphere* alone be used for the actual gaseous fluid which surrounds us, using the word *air* when the mixture of pure oxygen and nitrogen only is intended.

Pure air, therefore, may be stated to consist of 79 parts of nitrogen gas, mixed with 21 of oxygen. To this mixture there is always added a small proportion of carbonic acid gas, probably about four parts in 10,000 of the other gases. As this small portion of carbonic acid is always found, it is generally allowed to be reckoned as forming a part of the constituents of chemically pure air.

By the law of diffusion of gases which we have already noticed as playing so beneficial a part in dispersing collections of foul air, all noxious gases, vapours, emanations from animal and vegetable bodies, and odours, readily find their way into the surrounding atmosphere, and become more or less intimately blended with it. These constitute the *real impurities* of the air, and not any difference in the proportion of oxygen; and, in speaking of the atmosphere as polluted, or rendered deleterious to health, this definition of the terms should be borne in mind.

Irrespective of the impurities of the atmosphere, its physical conditions are of great importance. These are its weight or pressure, as determined by the barometer; its temperature; moisture or dryness; and, lastly its electrical condition. Of late years much attention has been called to a modification of the oxygen termed by chemists *ozone*, and its greater or less quantity seems to have an important bearing upon the salubrity of the atmosphere. It will be requisite to pass all these conditions in review under the present head.

Carbonic Acid Gas.—The cause of the greatest and most important impurity of the air we breathe as regards health and disease, is undoubtedly an excess of carbonic acid gas. This gas is the product of combustion. It results from the burning of wood, coal, or other carbonaceous substances, in the open air; hence its prevalence in the atmosphere of towns.

Another source of this gas is vegetation. During the night, and at certain stages of their growth—germination and flowering, for example—trees, shrubs, and vegetables emit large quantities of carbonic acid. But the chief source of this gas, as it affects human health, is the animal body itself. A few years ago it would have been described, according to the fascinating theory of Liebig, as the product of combustion here also—namely, the burning up of the carbonaceous materials of the food, and also of the effete structures of the body, by means of the oxygen inspired at the lungs, and the consequent formation of carbonic acid.

Animal Heat.—By the formation of this gas in the manner described, Liebig and his followers accounted for the principal portion of the animal heat, and carbonaceous food was considered by them as chiefly useful in keeping up the normal temperature of the body. So that oil, fat, butter, sugar, and other substances rich in carbon, were stated to be more essential to the natives of cold countries than to the inhabitants of warmer climates, and in winter than in summer. The progress of physiological science, however, has somewhat modified these views; and it seems probable that at least a large source of animal heat will be found to be in those molecular changes which are incessantly going on in the tissues of the body, both in laying down new substance, and in removing that which has become effete and useless. The chemical composition of the minute atoms of the bodily substance is constantly undergoing change; and oxygen is the medium by which these changes are effected. Here it seems to be that heat is liberated, and, by the laws of convection and radiation, dispersed throughout the whole animal frame.

The amount of carbonic acid expelled from the lungs is very nearly equal, volume for volume, to that

of the oxygen inspired; so that a relation of the most intimate kind exists between the rapidity with which oxygen is withdrawn from the air and that by which its place is supplied by carbonic acid gas. Upon this fact hangs the prime importance of ventilation.

The quantity of this gas which is excreted from the lungs of a healthy individual is about 1345 cubic inches, or 636 grains per hour. One hundred and seventy-three grains of carbon are contained in this quantity of the gas; and thus, not less than eight ounces of carbon—charcoal—are daily got rid of by the system in the process of respiration; and, as the skin also exhales carbonic acid, two or three ounces more are to be added for the total daily excretion. Let any one take half a pound of pure charcoal powder, and disperse it through the atmosphere of a chamber, and, as it settles upon and pollutes everything in its way, he may form some idea of the necessity of giving a wide berth, by letting in plenty of air, to such a mass of deleterious and offensive matter.

Along with the carbonic acid gas there is exhaled into the atmosphere, through the lungs and the skin, watery vapour, carrying with it animal matter, the product of secretion, of the most deleterious character. These, however, will be adverted to hereafter.

Now the quantity of carbonic acid eliminated from the system is the measure of the activity of the vital functions going on within it. As it is entirely formed by the union of oxygen with the refuse particles of the body, and probably with the excess of carbon and hydrogen in the food, it follows that for every grain of the gas excreted at the lungs and skin, a corresponding portion of matter must have been extracted from the blood, or detached from the tissues of the body. Healthy people, and those who use a good deal of out-door exercise, exhale a much larger

amount of carbonic acid gas than those whose respiration is embarrassed by confinement in close rooms, or who make but little use of their bodily organs.

The excretion of carbonic acid gas at the lungs is influenced, to a considerable extent, by the kind of food taken. Farinaceous and oily matters, and a vegetable diet generally, as possessing a large proportion of carbon, increase it; whilst a more animal diet, wine and spirituous liquors, coffee, and tobacco, diminish it. Hence persons who use these last articles in excess are unable to undergo the highest amount of physical exertion of which the frame is capable; neither are the intellectual functions performed with the same clearness and precision, as when this class of food and drinks are used sparingly. The quantity of carbonic acid which exhales from the lungs is greater in cold weather than in warm, and in a dry state of the atmosphere than in moist and rainy weather. Here is a physiological reason why muscular exertion is so much easier, and so much more grateful to the feelings, in cold, frosty weather than when the air is close and muggy; and generally, in cold and bracing climates, than in warm and relaxing ones.

Relation of Digestion to Respiration.—Many scientific explanations of the laws which govern the functions of the animal economy are only confirmations of the correctness of popular notions on the same points which have been founded *empirically* on simple observation. Consequently, those who delight in derogating from the value of scientific authority as a guarantee of the propriety of our most common habits of life, are apt to cry out, whenever such habits or customs receive the sanction of exact science, that they knew it all before, and that the universality of the custom was sufficient evidence of its rectitude. This may be so, but it does not lessen the satisfaction which a person accustomed to reason

and to weigh evidence correctly, must always feel when he finds that the instincts of nature, and those habits which have become almost as fixed as instincts, spring from the same foundation upon which inductive science is based. These observations are made *à propos* of the old and universal belief that fresh air is necessary to good appetite. The correctness of the chemical theory of digestion and nutrition is borne out by daily experience. The feeling of hunger is called forth to warn us of the want of new matter in the system to replace that which has become worn out and removed. If the body be in health, the waste of material and discharge of effete matter are directly dependent upon the quantity of oxygen inspired, and the corresponding amount of carbonic acid gas got rid of by the lungs and skin.

Now we have shown that, in the normal condition of the system, all waste of substance which is brought about by exercise is immediately replaced by new tissue. In order that the materials of this new substance may be duly elaborated, they must be fully exposed to the action of oxygen taken in at the lungs, and oxygen cannot be taken in except an equivalent proportion of carbonic acid be thrown out at the same time.

The two functions, therefore, of digestion and respiration occupy opposite sides of the same circle. The current of newly-made chylous fluid which, starting from the digestive organs, reaches the lungs by traversing one half of the circle, to be there finally elaborated into perfect arterial blood, returns to the stomach in completing its round, and there affords the healthy and sufficient secretion of gastric juice, without which no perfect digestion can be effected.

It is to the retention of effete and devitalized matter in the system that habitual want of appetite, nausea, and even loathing of food, are owing. Whenever a due supply of oxygen is denied to the lungs,

whether from disease of those organs or from deficiency of pure air, then the appetite will immediately fail, because the product of destructive action, carbonic acid, is not removed, and there is no room for the deposition of new substance. All the vital functions are now embarrassed. The clogging or stoppage of one wheel involves the disarrangement of the next; and so on, until, in the highest degree of disturbance, the whole vital machinery is brought to a standstill.

The retention of carbonic acid in the blood has other and even more deleterious effects upon the system than the suppression of appetite. They may be well studied in the case of persons long exposed to the effluvia of a large number of persons in crowded assemblies, churches, ball-rooms, &c. The first effects are generally excitement of the heart's action, palpitation, nausea; then headaches and giddiness, perhaps vomiting, want of sleep. If the body has been exposed to an atmosphere loaded with carbonic acid for any length of time, fevers and inflammatory attacks are very likely to ensue. These symptoms may be regarded as the result of the vigorous resistance of the system, unaccustomed to such an abnormal condition, against the morbific action of extraneous matter. But they do not show themselves in such intensity in the case of persons who pass most of their time in-doors or in crowded workshops. By daily use, some persons become accustomed to the presence of a large quantity of this deleterious gas in the air they breathe, and, after a time, especially if they have passed early youth, scarcely experience any distress from inhaling an atmosphere which, to one coming fresh from country air, would be almost irrespirable.

There is no doubt but that the adaptability of the functions of our bodies to changing circumstances is very great. This is seen in many ways. In the im-

munity from the effects of cold of those who habitually labour in the open air; also in the way the digestive organs adapt themselves to almost any variety in diet and regimen. In these cases, vital chemistry is able to supply the wants of the system out of very unpromising materials; but those materials *do* contain the elements of the bodily structure. But in the case of the habitual substitution of carbonic acid gas for oxygen, a *necessary* material is excluded, whilst an unnecessary and even poisonous one is substituted for it. Chemistry, with all its powers, cannot supply the place of oxygen by any other substance; whilst the carbonic acid not only does not nourish, but absolutely poisons the organs through which it circulates. It is a direct depresser of all the functions; it reduces the force of the heart's action, dulls and blunts that part of the nervous system by which the functions are regulated, and it stupifies the senses and intellect to a greater degree than any other agent which is habitually received into the system.

Carbonic acid gas, from its freedom from odour, may be present in the atmosphere which we breathe, in even a poisonous degree, without its presence being suspected by those who inhale it. The suffocating power of the gas in a concentrated or undiluted state may be appreciated by drinking rapidly a glass of soda-water from which the gas is issuing with force, and comes in contact with the glottis, or top of the windpipe, as it passes along in the act of swallowing. Many persons cannot swallow a glass of soda-water or ginger-beer *at once* without experiencing a feeling of impending suffocation and almost loss of consciousness.

ANIMAL MATTER EXHALED FROM THE BODY.

Leaving now the important subject of the part played by carbonic acid upon the organism, we come to another source of atmospheric impurity, and one

which, although not very palpable to the senses, and, until lately, but little appreciated even by the scientific, cannot be over-estimated in its deleterious effects upon life and health. Along with the breath, there leaves the lungs, at every expiration, a certain indefinite quantity of vaporized *animal* matter. The skin also exhales along with the watery vapour which is *always* passing from it a large quantity of a similar material. The sensible perspiration, or sweat, contains a still larger quantity, although not in so elastic and gaseous a state as the former.

It would be a mistake to suppose that these effete matters are in a state resembling putrefaction. In the healthy condition of the system, they are little appreciable by the sense of smell; although, if long retained, they become particularly disagreeable to it. After leaving the body, it is probable that chemical changes rapidly take place in them, and, if freely exposed to oxygen, their deleterious operation is soon removed.

Of what do these emanations consist? They are doubtless *secretions* from the lungs and skin, just as bile is secreted by the liver and urine by the kidneys. Had it been their office to subserve some useful purpose *within* the system, as is the case with bile, their retention would probably not have been so speedily followed by serious consequences to the individual, nor their effects upon others so destructive; at least, the analogy of other secretions leads us to that inference. Some portion of the exhalations from the lungs and skin is made up of matters very similar to those of the kidneys; phosphatic and common salt, and urea, being often found in the perspiration.

But a pure and healthy skin is certainly, taking the whole population, the exception rather than the rule. The great mass of the people so neglect the purifying of their skins, that the secretions are, to

a great extent, retained, or become so vitiated that they acquire a greatly increased degree of offensive and poisonous qualities. It is in their case that prolonged communication or virtual contact in close and unventilated rooms generates a poison which acts upon the system of all those exposed to the effluvia, more especially those who habitually breathe a purer air, with such virulent effect. Whether it be that the secretions in this case are in a state of chemical change, or of putrefactive fermentation, it is then that they become capable, not only of propagating diseases which are actually present, but of originating others which, in a pure atmosphere and amongst cleanly people, are seldom found.

SECT. III. VENTILATION.

The practical deduction from the foregoing facts leads us to the conclusion, that preventive means for such great and almost omnipresent evils are of the primest importance towards the maintenance of life and health; and, at the risk of some tediousness, the subject of ventilation in respect of climate and temperature, and as it affects persons of different ages, temperaments, and occupations, must be passed in review.

The object to be obtained by ventilation is even now but imperfectly understood by the mass of the people, if indeed it be by the more educated classes. The diminution of oxygen in the air which is being respired by a number of persons assembled together is *not* the particular evil to be guarded against. It is the addition to the air, as already explained, of carbonic acid gas, and ANIMAL MATTER IN A VAPORIZED STATE, which constitutes its foulness. The oppression which is felt on entering crowded rooms, and the close dwellings and the ill-ventilated courts and alleys of our towns, is not caused by any loss of oxygen to the system, but by the inhalation

of air which has been already breathed over and over again, and which holds in suspension the above-named substances. It is not enough, therefore, to let oxygen *in*, unless, at the same time, these emanations be let *out* of such places. According to the law of the equable diffusion of gases, the pure air entering mixes with the foul air within, diluting it, but not destroying its impurities. Means must be secured to pass a stream of fresh air continually through all places where foul air accumulates, to prevent the saturation of the air with these emanations. In warm weather, the atmosphere is more rarefied, and enters a room with less force than in cold; consequently a larger amount of ventilation will be required to effect the *same* change in its constituents.

VENTILATION AS REGARDS CHILDREN.

Those who require the largest amount of ventilation are children. The activity of their functions, represented by the rapid changes and progressive increase of the particles composing their bodies, produces a larger quantity of effete matter in proportion to their size, than is the case in adults. Their respiration is, therefore, more rapid than that of grown-up people; and they are more intolerant of a close and still atmosphere. The rooms they inhabit should be lofty, well-ventilated, and never overcrowded. It is from the neglect of these precautions that fevers and other contagious diseases so often break out in schools, workhouses, asylums, and other places wherever large numbers of children are crowded together.

The proper way of ventilating schoolrooms is the same as that which is found most effective in the wards of hospitals—viz., by windows opening widely on both sides of the room, and, if possible, at the ends also; the air being raised to a proper temperature by means of large open fires. In this way, the

animal matter will not only be well diluted, but a large portion of it will be burnt up, or carried by the current up the chimneys. The same plan must be adopted wherever children sleep in numbers together. All the windows should be opened during the driest part of the day, and closed before sundown; and when the dampness of the weather prevents the air of the rooms from becoming dry, a fire should be lighted during the latter portion of the time the windows are open. Rooms which are large, but in which but few children sleep, may be ventilated in bad weather by admitting the air in a distant part of the house, and so letting it pass through a warmer medium before it reaches the bedroom. This will be better than filling the room with *cold*, *raw* air, which a small number of inmates are unable sufficiently to warm, as it will prevent a chilling effect upon the skin during the night. In *hot* weather there should be an access of air by the windows (taking precaution against partial draughts) all night, as the warmth of bed induces free perspiration in the excitable skins of children, and a great quantity of moisture and animal excrementitious matter is thrown into the surrounding atmosphere. The condensation of this upon the skin, and the inhalation of it by the lungs, when means are not furnished for its escape, is likely to produce much more serious consequences to the health of children than what may be justly feared from the admission of night air in very warm weather. It is, however, proper to reiterate that when the outer air is cold, raw, or very windy, the *worst effects* may be feared from its free admission to the relaxed skins of children and persons in delicate health, during the night. In this case, while the body is enclosed in a temperature of nearly 100°, and perhaps perspiring freely, the lungs are subjected to the impact

of air not much above freezing-point, already loaded with moisture, and therefore in no condition to absorb that which should freely escape from the lungs and skin. The common opinion that colds are generally caught in the night is thus verified; and irritation, congestion, or even inflammation, of the lungs and air-passages is frequently set up.

Ventilation of Bedrooms.—Whilst on this part of the subject, we may advert to the ill effects of admitting *cold and damp air* into the sleeping apartments of any class of persons. There is a foolish prejudice in this country against fires in bedrooms, arising from the erroneous notion that they relax the system, and make it more susceptible of cold.

Cold moist air is at all times prejudicial to the system; and more especially so when exercise cannot be taken, or the body is in repose. There is not then sufficient reaction in the circulation to resist its effects in condensing the secretions of the skin upon itself, and in checking their escape by way of the lungs. Wherever a number of persons are collected together in such an atmosphere, without the means of dispersing or drying it, very bad effects upon the system are induced. Not only are the secretions of each one retained to a deleterious extent, but he is made to inhale those of all the rest at the same time. This is the *real* cause of the rheumatisms, neuralgias, biliary derangements, also of bronchitis, sore throat, and most of the diseases which are attributed to cold alone. The public should be made aware that cold, *simply as reducing temperature*, is trivial in its effects upon the system. The diseases and disordered functions which are vulgarly attributed to cold (and their name is legion) all owe their rise to one of these two conditions of the atmosphere: it is either so loaded with moisture and animal matter *already*, from prolonged contact with the animal

body, as to be incapable, according to the law of diffusion of gases, of receiving more than a small part of what should be removed from the body; or else, in the second place, it is so cold and moist when admitted to the frame, as to condense and drive back upon the system the secretions which are struggling to gain exit from it. If these physiological, or rather pathological statements are true, and every physician has daily evidence of their correctness, what shall be said of the stupid practice of leaving the windows of sleeping-rooms open in cold damp weather, far into the evening or night? Every purpose of ventilation is frustrated by such a proceeding. The comparatively warm air which has been admitted during the day is expelled by the colder and denser air which enters after, or even before sunset; and the inmates proceed from the warm and over-dried air of the sitting room, the temperature of which in the evening often reaches to 70°, to pass several hours in a room not above 35° or 40°, filled with moisture and the emanations which are borne in along with the night air! Can it be wondered at that delicate people say they catch cold during the night, an assertion which would be incredible were it not for the commission of such follies as these?

Fires in Bedrooms.—But to return to fires in bedrooms. The assumption that they cause relaxation of the skin, or a tendency to take cold, is based upon their *abuse*, and not upon their proper use. Fires should be used not so much to *heat* the air of bedrooms as to *dry* it. For this purpose, they are better to be lighted some hours before retiring to rest, and after the windows have been closed. They may then, with advantage, be allowed to go out at, or soon after, bedtime, except in very severe weather, or in the case of very delicate or invalid persons. Used in this way, there is no weather

when sleeping apartments may not be sufficiently ventilated; and in low or damp situations and the closer parts of towns, this is the *only way* in which pure air can be secured during a considerable portion of our winter and early spring.

With these precautions respecting the admission or retention of cold and moist air in sleeping apartments, we may complete what is necessary to be stated regarding their ventilation in general. The principles upon which we have to act are these :—During sleep all the functions of the body are reduced in vigour; the pulse and the respiration become slower, the skin relaxed, and the power of resisting cold, or perhaps any morbific agent, is lessened. In order to give repose to the respiratory organs, which the diminished excretion of carbonic acid gas during sleep shows that they require, the air should be still. To promote this state of the system, then, a moderately warm, dry, and still air should surround the sleeping body. Even the necessity for removing the carbonic acid which surrounds the sleeper may be questioned, looking at the habits of the inferior animals. But we shall advert to this subject again under the head of SLEEP. All animals, when composing themselves to sleep, get away from the wind, as may be seen in a flock of sheep seeking the sheltered side of a hedge for their sleeping-place; and most of those which are gregarious huddle closely together, so as to create an atmosphere of warmth around them.

Resting upon these facts, the ventilation of sleeping apartments should be effected in this way :—So soon as the occupants have left the room—not before —the bedclothes should be entirely removed from the bed and hung upon a clothes-horse or the backs of chairs, the bed shaken up, and all curtains, if used, drawn closely to the bedposts. The windows are now to be opened widely at top and at bottom. If

in warm weather, healthy people wish to dress with the windows open, to enjoy the invigorating breeze, this should not be done until washing and the proper amount of friction shall have braced the relaxed skin. This done, an air-bath for a few minutes is very delightful.

The windows are to remain open in summer, or in very fine weather, until a little before sunset; in very sultry weather some air may remain on all night. In winter and early spring they are to remain open until a *little after mid-day*, when the warmth of the air is greatest, and *then* to be closed. In this way the air of the best portion of the day is shut in and reserved for respiration during the night, when the external air is at its worst. By this proceeding the air is not deprived of any of its purity if the room be inhabited only at night. As already stated, when it is essential, from the construction of the room, or the number of persons sleeping in it, a fire should be lighted for a few hours during the afternoon, in very cold and damp weather, so as to dry the air which has been shut in. This is the only way in which the exhalations from the bed-clothing, &c., can be got rid of in such a state of the atmosphere, and the sweetness and purity of the clothing and other materials which are kept in the drawers and wardrobes secured.

The Ventilation of Sitting-rooms is more difficult of attainment, in a satisfactory manner, than that of bedrooms. In consequence of their being inhabited for the greater portion of the day, a large supply of air is requisite, whilst the presence of the inhabitants necessitates the avoidance of partial draughts. As a rule, the ventilation of this portion of the dwelling should be conducted upon principles very nearly the exact opposite of those which obtain for bedrooms. A constant supply of air, but admitted more gradu-

ally, and by smaller apertures, is best for small rooms; larger ones will bear the opening of windows without danger. Whenever the construction of the room admits of it, the air should be admitted on the side opposite to the wind, as, in towns, the wind will often bear in along with it some unpleasant odours or exhalations. Every principle may be overdone, and ventilation amongst the rest. There are people who, either from habit or prejudice, cannot remain in a room without a window or door being open, and will cause everybody but themselves to shiver, in order to carry out their professed principles. In all houses of tolerable size, and well constructed, there is no necessity for a constant rush of air into sitting-rooms. The inhabitants of such houses are seldom overcrowded, and the frequent passage from one room to another, and the opening of doors, causes a sufficient change of the air for ordinary purposes. All beyond this produces cold and draughts. The best way of thoroughly ventilating such sitting-rooms is to open wide the windows during the temporary absence of the inmates, and when the air is thoroughly changed, to close them again. Air may also safely be admitted in an indirect way by causing it to pass through other rooms or passages before entering a room where persons are sitting. These observations of course apply only to cold, or cold and damp weather, as there can be no difficulty about letting in plenty of air during warm weather.

The ventilation of the houses of the poor is a different matter. Here overcrowding is the rule, whilst in the dwellings of the affluent it is the exception. In *every* apartment of a poor man's dwelling there should be a ventilator fixed in the window and another into the chimney back. The bedrooms are generally small and low, and the accumulation of deleterious gases from several human beings, together

with the excretions of children, are apt to become offensive and dangerous. Hence there is no occasion for heating the atmosphere of these rooms. The cubic space is generally insufficient to sustain the respiration of as many individuals as are crowded into them. They cannot, therefore, with propriety be left in the same atmosphere all night. Air should at all times, except in the very worst weather, be slowly passed through the room, and this may be effected by inserting a small perforated zinc plate into one corner of the window, and an opening made into the chimney close to the ceiling. If there be no fire-place, a sliding-panel may be placed in the door.

Miss Nightingale, in her admirable "Notes on Nursing," drew attention to the neglect of ventilation of the bedding amongst the poor. My experience leads me to say that it is almost in an equal degree ignored by persons in middle life. There is no doubt but that the quantity of animal matter which makes its way into the bedding and mattresses in most houses is immense. A few old-fashioned people are in the habit of having the contents of their beds and mattresses turned out, sorted, and overhauled at stated periods; but as a regular and frequent proceeding it is to be feared that it is seldom thought of by the generality of housewives, the poorer sort especially. Much of the musty, sickly smell of their bedrooms is owing to the want of more frequent drying and ventilating of the blankets and other absorbent articles of bed-furniture.

Ventilation of Public Buildings.—Little need here be said upon this branch of our subject, because it has, perhaps more than any other sanitary precaution, attracted the attention not only of architects and builders, but of the public at large; not that it is by any means in a complete and satisfactory state, either as regards the theory or practice of it; but

the subject is too vast to admit of proper handling in a work like the present. The general principles upon which ventilation of all places in which large numbers are congregated for a short space of time should be based, may be drawn from the fact that in such assemblies a much less cubic space is allowed for each individual than what is found to be requisite in private houses. It is supposed that the short time during which the assembly remains thus crowded is equivalent to greater cubic space. This may be true to a certain extent; but the emanations which arise from a closely-packed audience in public rooms, unless fresh air sweep through the apartment with great rapidity, become so intensified in their effects as to give rise to serious disturbances of the system in a short space of time. The gaseous matter excreted by the lungs and skin of the whole mass of people is breathed over and over again, giving rise to nausea, headaches, palpitation, &c. It is these effete matters, re-introduced to the blood, which produce such bad effects upon the system, and not the mere temporary reduction in the amount of oxygen. The proper remedy for the effects of crowded evening assemblies, ball-rooms, &c., is a walk or ride in the open air for some time before retiring to rest, after the body has become cooled sufficiently to bear it with safety. By this means the stimulus of fresh air soothes the excited circulation, and allays that nervous irritability which disturbs or banishes sleep.

SECT. IV. EFFECTS OF THE AIR OF CERTAIN LOCALITIES UPON THE CONSTITUTION.

We have already adverted to the erroneous notion that the advantage which the country air possesses over that of towns, depends upon a larger amount of oxygen in the former than in the latter. It is the additions to, and the adulterations, so to speak, of

the atmosphere of towns which produce its depressing effect upon the feelings in almost exact proportion to its amount of impurity. I may, perhaps, exprcss my meaning better by saying that A of the town is not detrimented as compared with B of the country by so much healthy stimulus being *withdrawn*, but by a certain quantity of morbific matter being *added*, which obscures, and in part nullifics, thc natural effect of the vital stimulus of air. All this is made sufficiently evident by the improved health and tone which the inhabitants of those places which have been subjected to the Health of Towns' Act enjoy; and the good results, especially as regards the poor, which any unprcjudiced observcr cannot fail to note, are a guarantce to us that we are travelling in the right direction, and that pure air and pure water, introduced in sufficient quantity into the courts and alleys and crowded streets of our cities, will, in time, prove a match for disease, so far as it depends upon removable causes, and also elevate the physical and moral condition of our civic population.

Atmosphere of Towns.—The noxious exhalations of towns consist for the most part of animal matter, to which must be added the carbonic acid gas resulting from thc rcspiration of men and animals, and the combustion of coal and wood for firing. The immunity of many tradcs from any bad effects from imbibing thc exhalations arising from dcad animal matter instigates the inquiry into the difference between those which are harmless, and those which we have just advcrted to as so dangerous and even poisonous to the system. It is well known that various trades which necessitate the inhaling of the most nauseous smells arising from animal mattcr—thosc of knackers, skinners, glue-makers, bone-boilers, candle-manufacturers, butchers, and othcrs, are by no mcans more than usually unwholesome, or injurious to thc hcalth

of the people engaged in them; yet here the animal matter is undoubtedly in a state of putrefaction. Again, it has been noticed that medical students are not nearly so much affected by many hours of daily attendance in the dissecting-room as they are when closely attending on the sick in hospital.

Nature of Poisonous Animal Matter.—What is it that constitutes the difference between the horribly disgusting and stinking materials in most of these cases, and the almost inodorous and imperceptible emanations which rise from the perfectly clean and well-kept bodies of those who congregate in churches, assemblies, concert-rooms, or even, if too crowded, in our own sitting-rooms? Chemistry has not yet solved this riddle. It points out that, so far as is known, there is no difference of constitution in these substances to which we can attribute their widely different effects. The one kind are putrefying as well as the other. Whether an animal substance shall become a poison when introduced into the system can only be known by experience, and we must hope that well-directed observation, such as is now going on in the great schools of medicine, will, ere long, bring us nearer to the knowledge of that peculiar condition of effete animal matter upon which its virulence depends.

What is now known is, that the secretions and excretions—some of them even when fresh from the body, as carbonic acid and the matters of perspiration; others, when they become putrid, as the more decided excrementitious matters—cannot be inhaled, except in a very small quantity and for a short space of time, without poisoning the sources of health, by embarrassing all the functions of the body; that of the nervous system in particular. The depression caused by their inhalation is a decided reduction of the activity of life; and hence the true difference, in

effect, between the pallid townsman and the ruddy complexioned resident in the country. Our utmost efforts should be directed to remove all such emanations from the air we habitually breathe. To effect this, efficient ventilation of the dwelling houses, of lanes, alleys, and courts; the frequent removal of animal matter from the back premises; and especially the yearly whitewashing of ceilings, and the *careful rubbing down of papered walls*, are required.

Atmosphere of Country Districts.—As there is no excess of oxygen, nor of any other vivifying principle, in the air of country districts over that of towns, the superior salubrity of the former, as compared with the latter, must consist chiefly in its freedom from deleterious admixture with other gases, and with animal exhalations. Yet we say we go into the country to enjoy *fresh* air. In what does the freshness consist? It may be answered that the air in the country is generally cooler than that of towns; it is also in more rapid motion. These two circumstances make it more stimulating to the skin and lungs. The impact of cool air upon the skin of the face and neck, is highly stimulating to the system. The excitement of the nerves of the face assists the action of the muscles of the chest in respiration, which becomes deeper and fuller under its influence. Hence more oxygen is drawn into the system (although the air does not contain a greater relative proportion of it), and the vigour which this gives to the nutritive functions reacts upon the frame and nervous system in producing a feeling of exhilaration and renewed strength.

Mountain Air.—This feeling is more especially called forth when we ascend hills or mountains of moderate height, like those of these islands. To persons of tolerable health, every step of ascent removes a portion of the incubus of inertia, and

increases the feeling of lightness and buoyancy. The more rapid respiration, imbibing more oxygen than usual, refreshes the blood, which, in its round amongst the organs, stimulates them all to increased action, and the brain to nicer preception and more hopeful thoughts. In this process, a large quantity of the substance of the body is rendered effete (used up), and a vacuum provided, which nature craves to fill. Hence arises the increased appetite which climbing scarcely ever fails to excite ; and the feats in this way sometimes performed by delicate ladies, who at home in the city feed almost like the chameleon—on air—can only be believed by those who have been eye-witnesses of their prowess in this respect when on a tour of sight-seeing in a beautiful country. No doubt the excitation of the senses—sight, hearing, and feeling—with the exhilaration of mind which novelty and adventure produce, have also a share in increasing the natural secretions, and amongst others that of the gastric juice. Indeed the increased purity of the blood is the immediate and only strictly logical factor in improved digestion.

Mountain air, however, is not to be credited with more than it really merits. It must be remembered that the persons who feel the highest degree of pleasure, and reap the greatest benefit from it in improved digestion and muscular vigour, are not those who *reside constantly* amongst the mountains. It is the careworn citizen, the toilworn artisan, the jaded man of pleasure, and the over-worked student, who feel so keenly the wonderful effects of mountain ai-. Hence there is a combination of beneficial influences to bring about a favourable result : freedom from daily care, agreeable company, fine season of the year, the contemplation of the grand and beautiful in nature—all combine to elevate the spirits and set free the nervous system from the load which oppressed

it; bringing it into a condition to be favourably excited by increased bodily exertion. Consequently, it is as *change* that mountain air is so valuable, and the custom of a weekly, monthly, or seasonal run upon the Malvern hills, the Welsh mountains, or the Sussex downs, now, thanks to cheap railways, becoming so common, can be justified by the dogmas of physiology as well as excused by the promptings of the love of change.

Noxious Emanations in the Country.—As a counterpart to this glowing view of the advantage and delights of breathing the country air by those who are habitually pent-up in towns, we must set certain evils which a residence entirely in the country is not free from. Animal exhalations, we have seen, are the principal means of contamination of the air of cities; vegetable matter in a state of decomposition is the pest of that of the country. Many a quiet rural village approached by green lanes, shrouded by tall trees from the full force of the wind and sun, contains within its own bosom the elements of disease and death. We have seen many such, which on a cursory inspection would be thought to be the residence of Hygeia herself; but on looking a little deeper, we discover the stinking pond, running over into a ditch which perhaps passes close under the windows of the cottages. Into this pond or stream, the drainage from the farmyards, dead animals, and decaying vegetable matter, are carried by every rain.

Decaying vegetable matter seems to be more active than animal matter in the production of some forms of fevers, as typhoid, for example. Many country villages are periodically almost decimated by this self-bred pestilence. The fevers of children are always injuriously affected by it. Ague is not now a common disease in this country; but in many marshy

districts, and where there is much stagnant water, as by the side of canals, the people are pallid, weakly, and suffer from an agueish disorder particularly affecting the nervous system.

The evils which arise from decaying vegetable matter are most rife in the autumn. It is when the leaves are turning brown, and the grass is rotting at the root, that decomposition is set up, and the alternate wetting by the dews of night, and drying by the heat of day, produce emanations which are so injurious to the nervous system. The leaves of trees fall into ditches, or lie rotting in moist places. All these should be carefully removed from the neighbourhood of dwelling houses, lawns, gardens, &c., and either burnt, or buried beneath the soil. There are instances in which malarious effluvia, arising from decaying vegetable matter, have travelled over a considerable space of ground, even in this country, and country houses, otherwise healthy, rendered uninhabitable by them.

SECT. V. WINDS.

We must now briefly advert to the effects upon health of the various winds which prevail in this country, and of the hygrometric and other conditions of the atmosphere.

"Which way is the wind to-day?" Do we not know where this question is asked, every morning, with anxious face, as if upon the answer depended the bodily ease or pain, pleasure or misery, of that day at least? At Cheltenham, Leamington, Tunbridge Wells, Malvern, Brighton, or wherever else the idle and the invalid congregate, there is the wind the chief topic of conversation, the first inquiry after the morning salutation in the street. From the veto of this master of the ceremonies, as regards the day's amusements, there is no appeal.

In this climate no one but Admiral Fitzroy and

his collaborateurs can tell from what quarter the wind will blow to-morrow, or even the next hour. If, as in tropical climes, the wind set in for one half of the twenty-four hours from one certain direction, and for the other half from the other, people would know what to expect, and inquiries would be needless. Spring is the season when this question of the wind possesses the greatest significance. And why? Because the system, rendered delicate and susceptible by the care taken of the body during the cold of winter, is more easily affected by the constant changes of temperature and moisture which characterize the spring months of this climate. Children, too, make a good part of their growth in spring, and are at that time very susceptible of outward impressions.

Our most prevailing winds may be divided into four classes ; viz.—

1. The Cold and Moist.
2. The Cold and Dry.
3. The Warm and Moist.
4. The Warm and Dry.

The first of these—the wind of winter—prevails during the latter autumn and the winter months. From November to March, with intervals of fine, dry, frosty weather, or an occasional interruption of a warm and moist south-wester, we may expect the character of the air to be more or less *cold, with excess of moisture.* The effect of this kind of weather is especially hurtful to children and old people ; for the cold reduces the transpiration through the skin, condensing upon it that which does attempt to force its way out. Hence, the mischiefs which ensue arise from retained secretion of the skin and lungs. Rheumatism, from checked secretion of the skiu ; bronchitis, colds, and sore throats, from that of the

lungs, prevail. Scrofulous and consumptive persons suffer also in this kind of weather from the same cause.

The proper precautionary measures to be taken against the ill effects of this kind of atmosphere, are, to clothe the body from head to foot in warm flannel or cotton materials, according to the delicacy of the subject; or, what is generally the most useful, a mixture of the two. To be careful that, whenever the body is heated by exercise, or hot rooms, no sudden check be allowed to take place; and, whenever this has happened, to procure immediate reaction by applying warmth to the skin, by means of warm baths, confinement to bed, and the administration of hot and exciting drinks.

The frosty weather which is intermingled with the generally cold and damp atmosphere of winter is held by Englishmen generally to be essentially healthful; and it would be a hard task to convince them of the contrary. Norshall I attempt to doso. Frosty weather, however, is not really *dry weather*, for the moisture of the atmosphere which always precedes a frost is only condensed, and being frozen, falls in the form of snow or rime, or floats, in minute particles of ice, in the air. To the young and healthy, particularly to females, frosty weather brings many advantages. The weight of the atmosphere is great during a frost, and presses with more than usual force upon the surface of the body. This gives a feeling of support and tension to the organs; and the cold air stings and excites the nerves of the skin, producing a pleasurable feeling of lightness and buoyancy. Females particularly enjoy this, because they are more shut up indoors than men during winter, and their systems thereby get relaxed, irritable, and weak. So that a walk or a run a clear frosty day is new life to them; and, by the process already explained when speaking of

mountain air, all the functions are excited, that of digestion not the least.

Frost, nevertheless, is not without its dangers, especially when severe or long continued. It produces congestions, from the check to the surface moisture, unless a good deal of exercise can be taken; and hæmorrhages, either of the lungs or brain, often prove fatal. Persons with delicate mucous membrane, either of the lungs or bowels, should be careful of exposing themselves to frosty weather, except it be clear and sunny.

Winds that are very dry are generally accompanied by a high pressure of the atmosphere—the barometer standing at about 30 inches, fair and set-fair. They stimulate the skin by rapidly carrying away the moisture from it, exciting it to increased action. Those winds, on the contrary, which are accompanied with great moisture have a lower degree of pressure, and the barometer falls. In this case, the moisture of the atmosphere is unable to take up that of the skin as fast as it is formed, and hence the feeling of oppression and the perspiration which result if the weather be warm.

Cold and Dry winds increase this excitation of the skin to an unpleasant extent; and this it is that causes the *east and north-east winds* to be so much objurgated in this country. Who can say that they love an east wind? We might, indeed, fancy a universal grumbler to pretend to like it for the reason that everybody else detests it. In this climate, people are in the habit of submitting to the annual infliction of east winds as to a necessary evil. Nor are we likely ever to be relieved of their annual visitation, for it depends upon physical causes connected with our geographical position. What we denominate *east winds* are those which prevail for a longer or shorter time in spring, between the middle

of March and the end of May. The wind may come from the east, north-east, or one or two points to the north or south of east. The atmosphere generally puts on a sombre, greyish, murky appearance, which is owing to the absence of watery vapour in it, and perhaps to some peculiar electrical condition. It is hard to account for the peculiar penetrating character of east winds. Whilst scarcely a twig or a blade of grass is moved, the cold air seems to penetrate into our very bones, drying up their moisture, and making us feel peculiarly irritable and morose.

The persons who suffer most from east and north-east winds are those of the sanguine and of the nervous temperaments, who possess a peculiar delicacy of skin.

Cause of their Insalubrity.—The *modus operandi* is this. A certain degree of pungency is given to the atmosphere by dryness, which is agreeable to the feelings, and serviceable to the system by bracing the skin and contracting the vessels, which together give a feeling of liveliness and buoyancy of spirit. When, however, as is almost always the case with east winds, that dryness is carried to excess, such is the greediness of this air for moisture, that it rapidly absorbs it from all evaporating surfaces, such as the human skin and the leaves of plants. Look at the tender shoots and leaves of our garden-shrubs under the influence of a strong east wind. They have the appearance of having been scorched with fire, and we frequently see even the young leaves of the oak, so late as the end of May, completely shrivelled up by it, and the tree obliged to start a fresh growth.

And the effect upon the skin is also wonderfully like that of intense heat. It dries, shrivels, cracks, and, finally, inflames under the continued irritation of having its moisture so rapidly removed. Now,

when we reflect upon the millions of nervous points which debouche upon the 2500 square inches of our skin, knowing that each of these little messengers holds direct communication with the seat of sensation, of pleasure and pain in the brain, we shall cease to wonder at the irritation, and even moroseness, which many persons cannot help exhibiting during an east wind.

All *over* stimulation of an organ is injurious. By it, the proper secretion is exhausted, and sympathetic irritation is set up in other organs, especially in the great centre of sympathy, the lower brain and spinal marrow. Thus does an east wind in spring keep up *a perpetual raw* in the system, and every exposure to the outer air touches it up afresh, until the nervous system becomes irritated, the circulation in the internal organs congested, and attacks of hæmorrhage from the nose, lungs, or into the brain, are induced.

What gives to the easterly winds of our springs so much greater insalubrity, is the fact that we are in the habit, the richer classes at least, of coddling ourselves in over-heated rooms, and of thus rendering the skin more susceptible of change than it ought to be. Whilst the skin is in this state, we are tempted by the first fine days of spring to leave off some of our winter wrappings. The warm sun and cold wind form a conspiracy against us, somewhat similar to that practised by thieves in the street. Whilst the sun is lavishing his blandishments before our face to distract our attention, an imp of mischief rifles our pockets behind our backs, and we lose our vital warmth and moisture in the same imperceptible manner, in the one case, as we get relieved of our pocket handkerchiefs in the other.

Means of avoiding them.—The precautions to be

taken against the ill effects of east and north-east winds are simple. Avoid them altogether; or, if this is not possible, treat them as a concealed enemy. Trust nothing to their professions. Be prepared, however smiling the sky, with the same quantity of under-clothing as in mid-winter. There must be no open flowing garments at such a time, for the wind will penetrate through every crevice, if the dress be not pressed closely to the skin. Men should wear a great coat, fitting tight to the underdress, and closely buttoned up. There is *no* danger of exciting too much *sensible* perspiration, but there is great danger of the *insensible* perspiration of the skin being checked.

Many persons habitually suffer severe headache during an east wind. They feel as though a helmet of brass were pressing upon their brows. This arises from congestion of the vessels of the brain, and, if they are unsound, hæmorrhage may ensue. Hence sudden deaths are not uncommon during the long prevalence of these winds.

To those who suffer much from these symptoms just referred to, I would recommend as little direct exposure to east winds as possible, frequent warm baths to remove irritation and congestion of the skin, a mild and farinaceous diet, and abstinence from stimulants. Anointing the skin with oil, much practised in hot climates, is of great service here. The effects of extremely dry winds are much the same as those of very hot ones, and lubricating the surface prevents the too rapid escape of moisture.

Warm and Moist Winds.—The two other kinds of wind, the warm and moist, and the warm and dry, prevail chiefly, of course, in summer and autumn. Their effects upon the system may be inferred from that of their opposites in winter. And, as exposure to the fresh air cannot well be carried too far in this

country during the warm seasons, but little need be said by way of direction.

Warm and moist winds are generally from the south, south-west, and, in summer, from the west. Much active exercise in this kind of atmosphere becomes oppressive, on account of the tardiness with which the transpiration is removed. Linen garments should never be used next the skin in this weather, as they condense the moisture upon the surface of the skin, and that which should be exhaled is driven back upon the system.

These winds, when they occur in winter, cause what is called *close, muggy weather*, and are generally thought to be unwholesome; but to persons with delicate lungs and skin they are quite the reverse. Such persons revel in the balmy softness of the moist breath of a westerly breeze. Their lungs, irritated perhaps by long-continued detention in hot, dry air of the sitting-rooms of winter, or worse, by the biting east winds of early spring, now breathe again freely; their parched skin becomes relaxed, and the feeling of tension and worry gives place to one of delicious softness and pliancy. This is the true balmy breath of Zephyrus, which, even when accompanied by mist and rain, is more willingly braved by such persons in a whole day's exposure, than that of an hour to the trenchant east.

Warm and Dry Winds.—The last, and unfortunately the least common condition of the atmosphere in this climate is the warm and moderately dry. This is the condition most suitable to the animal frame. Everything combines to render such an atmosphere pleasant to the feelings, and healthful to the body. It seldom or never occurs in winter, occasionally from a south or south-west wind in spring. Summer, and especially autumn, are the seasons for this temperament of the air.

Their great Salubrity.—The dryness of the air, and its great pressure (as evinced by the high state of the barometer), rapidly removes the perspiration which is excited by its warmth. The functions are excited to more vigorous action. The tension of the skin, and the greater support of its vessels, excites in the brain a feeling of lightness which is most agreeable. It is in this kind of weather that both bodily and mental exertion are most easily undergone, and the waste of substance caused by them is rapidly repaired by increased digestion. No amount of exercise short of great fatigue can now be hurtful; nor is there the same necessity for care in the way of clothing as there is in all other conditions of the atmosphere.

Caution as to Night Air.—All that is necessary to be provided against is the sudden fall in the temperature which is apt to take place in such weather so soon as the sun has gone down. A cool breeze then often springs up, which sometimes amounts to frost at night. The body, heated and stimulated by the exertions of the day, is peculiarly susceptible to the change. An extra *outer* garment is what is required, and not any addition to the under-clothing.*

SECT. VI. ELECTRICAL STATE OF THE ATMOSPHERE.

Little is definitely known of the effect upon health and disease of varying electrical states of the atmosphere as distinct from those produced by the

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* Here, once again, we must repeat our caution about sleeping with open windows, except in hot, sultry weather. Much as the fashion is to recommend open windows all night, and in all weathers, it is founded upon an entire misconception of the objects of ventilation. It was all very well for Miss Nightingale, who experienced, at Scutari, the intense sultriness of an oriental clime, aggravated by the emanations from hundreds of reeking bodies closely packed together, some of them with putrefying sores or wounds, all of them

other conditions which we have now passed in review, and what is known is not easily communicable in a popular form. A positive state of electricity seems to be more conducive to tone than a negative one, during the prevalence of which latter some severe epidemics have been known to occur.

No one can doubt that there are other occult and mysterious agencies in the atmosphere which surrounds us than those here adverted to. Our feelings seem to vary daily, almost hourly, under the influence of some unknown and inappreciable changes in that fluid; so, also, those minute differences in the air of different localities, which constitute a climate, are felt and appreciated, although they are unexplained by us. It is probable that the nature of the geological formation of the locality may have much to do with these hidden properties of the air, which vary so widely even in places geographically similarly situate. Into a discussion of these it is not my intention to enter. Science is at work upon them, but at present nothing sufficiently definite is known about them to suit a manual such as the present.

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exhaling the products of disease—it was all very well and quite proper for her to insist upon a current of fresh air all through the night in such places, where to let in even pestilence by the windows was less dangerous than keeping the animal poisons from getting out. To apply the same principles to this climate, and to houses where plenty of fresh air can be obtained, was, perhaps, with her strong impressions, merely committing a venial mistake. But for those who pretend to physiological knowledge to repeat her directions as applicable to all weathers in this country, is simple stupidity.

CHAPTER III.

LIGHT.

Effects of light upon vegetation—Cause of colour—Effects upon animal life—Effects of the deprivation of light—Pigment-cells of the skin—Absence of light as it affects inhabitants of towns—Children—Necessity of exposing children to full light of sun—Schools; their vicious construction—Schooling out of doors—Effect of light upon invalids—General neglect of light in dwelling-houses, workshops, offices, &c.—Physical deterioration caused by want of light.

The beneficial effect of light upon the vegetable kingdom is well known to exceed that of any other natural agent. Everyone admits the necessity of a full exposure to the light of day to ensure vigorous and healthy growth in almost all plants. Their principal growth is made during that season of the year when light is greatest—viz., the latter spring and early summer months. As this is not the season when the *heat* is greatest (the months succeeding them having a higher aggregate temperature), we must conclude that light is a more potent stimulus to vegetation than even heat itself. So intimate is the relation between the daily and hourly growth of vegetables, and the amount and direction of light, that many of them turn their leaves or flowers to the sun throughout his whole course from east to west.

Light is, with some inconsiderable exceptions, the sole source of colour in plants: it is also necessary to the due elaboration of sap, and to the proper consolidation of the tissues. All this is familiar to the

botanist and to the gardener, who act upon this knowledge in almost every one of their daily operations. Notwithstanding this general knowledge of the effects of light upon the vegetable kingdom, its corresponding operation in relation to animal life, singular to relate, has attracted but the most cursory attention, and popular knowledge on the subject is therefore of the most hazy and indefinite character: and, in truth, physiologists are not yet able to define the *modus operandi* of light upon the animal tissues with nearly the same exactitude as they are in the case of those of vegetables; still, they have no doubt of the vast importance of this powerful agent as regards the preservation of health and the attainment of the full development of the animal frame.

The brilliant colours which we observe in flowers, birds, insects, especially in the equatorial regions, where the sun's rays are most powerful, are doubtless owing to the large amount of direct light which they receive. As we proceed from the equator towards the poles, the case is reversed, and more sombre colours prevail. Man himself exhibits a deeper colour of the skin as he proceeds from north to south, from colder to hotter and brighter regions. These various changes are effected, most probably, by the operation of the chemical rays of light upon that special vitality with which each species of plant and animal is endowed.

Effects of Deprivation of Light.—As regards colour, it is pretty certain that animals suffer very much in the same manner as vegetables when the stimulus of light is withdrawn: their fibre becomes blanched, brittle, and inelastic. The deepening colour of the skin which takes place on exposure to the full effect of the sun's rays depends upon an increase of the pigment-cells, which are naturally placed between the outer, or scarf-skin, and the inner, or true skin.

These are of a black colour, and their number regulates the depth of colour from the clear brown of the European brunette to the jet-black of the negro. There are, doubtless, variations in the effects of both light and heat upon people of different races; yet the colour of every race lightens or darkens according to the amount of exposure to the solar rays. Our observation informs us that it is the denizens of the darkest and dirtiest of our large towns, the occupants of the milliners' garret and the tailors' workshop, the office-clerks and shopmen who pass nearly the whole day in a murky atmosphere—whose skin is the most pallid, whose muscles are the softest and flabbiest, and whose nervous system is the most relaxed and irritable. What other conclusion can we draw, reasoning from cause to effect in the same manner as we do in accounting for all natural phenomena, than this: that absence of light and defective development of the animal body, with perverted functions, are related as cause and effect? In the case of children whose bodies are undergoing rapid change, this fact is exemplified in a marked manner.

Its Effects on Children.—It will be observed of children, that they are generally ruddy, so long as they have permission to run in the open air; but when they are old enough to pass the greater part of the day, and that the lightest part, in schools or workshops, their colour leaves them. This is generally attributed to confinement and want of muscular exertion; but the rapidity with which colour returns when exposure is resumed, shows, as in the case of etiolated grass which has been temporarily deprived of light, that when the shading is withdrawn, the *natural* effects of light at once develope themselves.

The colour which depends upon light is altogether distinct from that which is derived from the blood appearing through a thin and transparent skin. The

first depends upon a collection of pigment-cells under the outer skin; the second, upon the colouring matter of the blood.

The effect of the pigment-cells which give colour to the skin is to enable it to resist the blistering and irritating effects of the direct solar rays in hot weather. Hence the brunette complexion stands sun better than the blonde. Light also acts upon the tissues of the body directly in hardening them and supporting their elasticity. The muscles of animals, when they are deprived of a proper amount of light, become soft and inelastic, the nervous system loses its tone from defective stimulation, and the elaboration of cell-growth generally seems to be perverted.

The practical rules which may be given under this head are sufficiently substantiated by repeated observation to make their advancement in this place of too much importance to require apology. In the case of children, constant access to plenty of light through the day, and to the direct rays of the sun for a part of it, is most essential to their health. Light assists in the elaboration of good plastic blood out of the food, and hardens the fibre after it has been laid down. It also acts as a stimulus upon the organs of sight, and by this means brings about more activity in the various cerebral functions than would otherwise be the case. The rooms in which young people live in the day-time should be the lightest in the house, and no artificial barriers, as trees and walls, should exclude the sun's rays.

Schools.—The style of building best suited to admit the largest amount of light is that which should always be adopted for schools and other places where a large number of people, especially the young, pass many hours of the day. Yet how generally is this essential feature sacrificed to a fancied æsthetical feeling, which demands that all other considerations

should give way to correctness of architectural style, or to love of the picturesque! The Gothic, full of angles, with high-pitched roof and narrow chinks of windows, is the very worst of the forms now in vogue for schools. And this is to be the more lamented, as it is quite easy to obtain all the picturesque and ecclesiastical effect of Gothic architecture whilst retaining the regular walls and ample window space which belong to the Italian styles. In the warm weather of summer it would be well that much of the schooling should be done altogether out of doors. This was the custom amongst the Greeks, where, in the classic groves of Academus, the philosopher lectured to his disciples *sub Jove.* There is quite heat enough in this climate during several months, when the new growth which children make in the spring requires hardening and consolidating, for out-of-door lessons to be endured without danger. There need be no exposure of the head to the direct rays of the sun, as an awning carried over some upright supports would effectually prevent this, and keep off rain also.

Infants in arms are not exposed to the direct light of day nearly to the extent which nature points out as desirable. The young of the domestic animals are seldom found, when in health, to seek the shade.

Exposure to Light in Cases of Chronic Diseases.— The sufferers from many chronic diseases appear to be benefited by exposure, for a considerable time, to the direct rays of the sun. Asthmatics, and those who are afflicted with chronic disease of the mucous membrane of the lungs—bronchitis and emphysema— are particularly benefited by free exposure to the sun's rays when the air is dry. Generally, it may be said that the prejudice which extensively prevails, even amongst educated persons, against admitting light into rooms occupied by invalids is unfounded

and harmful. If it be asked, How is this so? I answer, that long illness generates a debilitated and dilated condition of the vessels and tissues of the body, and that exclusion of light prevents the contraction of the vessels, and the proper hardening of the new tissues formed during convalescence.

General Neglect of Light in Dwellings.—In a climate like our own, in which we surely cannot complain of having too much of Sol's company, that has always appeared to the writer to be a most marvellous and unaccountable prejudice which induces the generality of people to take every precaution to exclude the full light of day from their dwellings. Of course, ornamental furniture, resplendent with brilliant colours, must be protected from the direct rays of the sun, and this may be done by using suitable coverings during the time the sun plays upon it; but in every other way, and at all other times, the utmost possible amount of light should be freely admitted into our sitting-rooms, as well as into workshops, counting-houses, and especially into those places where a large number of persons are congregated within a small space. Go into any place so occupied, and what, nine times out of ten, do we see? The inmates pallid, with puffy, flabby features, fat, doughy hands, and lustreless eyes; or else the yellow cheek, the sunken eyes, the narrow chest, from which issues, at frequent intervals, the dry, teasing cough, which is not the forerunner of, but the indicator of the presence of consumption. The persons who suffer most from want of light are not always those who are deprived of a proper amount of air: they are clerks in banks, and other large public offices, shopmen, milliners in fashionable establishments, from which all sun is excluded with the very humane intention of preserving the colour of the rich tissues, and which arrangement has the

additional advantage of removing it also from the tissues of the youthful machines who are employed in their fabrication.

But, it will be said, the clerk or the shopman cannot bear the direct rays of the sun beating upon his head from a skylight, or flashing across his eyes from windows, all the day. Nor will fashionable ladies look serenely upon the faded splendours of their dresses when taken home after exposure to a week's sunning in the milliners' work-rooms. The reply is easy. Light must be had; colours must be preserved. Very well; the *slightest* tinting of the glass through which the sun enters, with the cool colours—blue, green, or grey—will suffice to reduce the evils complained of to a minimum. And if lights in the ceiling of the rooms occupied as we have described were more generally used, the larger amount of light so admitted would allow of the shade of tinted glass all the more readily. It ought to be unnecessary to enlarge upon this subject, yet it is one the importance of which may well bear iteration. It is bad enough to see country houses so closely encased in tall trees, as to receive less than half the light and air they ought to do; but what shall we say of people living in the narrow and angular streets of large towns, through which the sun's rays have hard work to struggle, or can only obtain a passage by "shooting," like Paddy's gun, "round a corner"—what shall we think of people so situated, drawing down their blinds whenever the faintest ray of sunlight forces its way into their dingy rooms? Can we form a very high notion of their intellect which can so misinterpret Nature's plainest teachings, or of the purity of their natural instincts, which can be thus deaf to her greatest charms? Let such persons cast a glance over the lovely hues of the flowers which deck with ever-changing colours our

gardens, fields, and groves: let them study the gorgeous colouring of birds and insects; the rich verdure of the spring landscape, contrasted with the deep blue of the impenetrable vault of heaven; and the whole lighted up by the golden majesty of God's vicegerent of the physical world, and then ask themselves whether He made all this only to be peeped at from behind a Venetian blind?

CHAPTER IV.

HEAT AND CLIMATE.

Normal temperature of the body—Power of resisting extremes of temperature—Forces regulating the animal heat—Comparative salubrity of hot and cold weather—Clothing—Means of preventing the escape of animal heat—Under-clothing; Best materials for it; for females; objections to it—Outer-clothing—Effects of Colour; of texture—Clothing of children—Climate—As regards place of residence—Residences for winter, spring, summer, autumn.

WE come now to the consideration of the *third* great natural vital agent—Heat. It is needless to discuss the question which may be asked in this place, viz., Why is a high temperature necessary to our existence? Why could not respiration and circulation of blood have gone on at the temperature of the surrounding atmosphere? That such an arrangement might have been made, we know, from the case of several of the lower orders of vertebrate animals—fish and reptiles, for instance—which habitually maintain a temperature of body much below that of warm-blooded animals, and only exceeding by a few degrees that of the water in which they exist. It is not the part of science, however, to inquire into first causes, and no sensible person asks why the arrangements of Nature are not otherwise than they are. The relations of structure to surrounding objects, and of both to individual function, are all links in the same great chain of Nature. That chain has been determined in the Divine mind; and the links,

whether we consider them to have been forged separately by its *immediate* operation, as commonly believed, or as springing out of each other by a process of natural development, as such naturalists as Mr. Darwin contend, are every one of them conformed to the typical unity of the great plan. The primæval fiat has been obeyed; all the parts preserve their relation to each other, as well as to affiliated structures; so that,

> "If from this chain whatever link we strike,
> Tenth, or ten-thousandth, breaks the chain alike."
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> "All are but parts of one stupendous whole,
> Whose body nature is, and God the soul!"

Normal Temperature of the Body.—It appears that a temperature ranging from 98° to 100° F. is necessary to enable the circulation of the vital fluids of the human frame to go on with rapidity sufficient to evolve a due amount of nervous force. When the heat of the body falls much below 98° for more than a very short period, the circulation languishes and stagnates at the extremities, and the nutritive functions are not performed with their normal force. A higher temperature than 100°, which is sometimes reached by exposure to intense solar heat, or during fevers, &c., over-excites the circulation, causing inflammation and hæmorrhage; or else it exhausts the nerve-force, as in the instance of *coup de soleil*, or sun-stroke.

The natural temperature of the human body appears to be the same, or very nearly so, in all climates and amongst every variety of the human race. It is at all times above the mean temperature of the surrounding air, and in high northern latitudes it often exceeds this by 50, 60, or even by 70 degrees.

Power of resisting Extremes of Temperature.—One of the most marked distinctions which exist between

man and those animals of the ape kind which most nearly resemble him in structure—the gorilla, the chimpanzee, the oran-outan—consists in the power which the former possesses of resisting the ill-effects of extremes of heat and cold. Whilst these anthropoid apes can only endure the climates of the torrid zone where they are found, man ranges from the equator to the poles, readily enduring all the extremes of temperature to be met with throughout the whole course of his peregrinations. It is true that specimens of these larger apes have been brought to this country, but without the greatest care to keep them in a high temperature, they languish and quickly become diseased. On the other hand, the experience of all Arctic explorers, from Parry to McClure, testifies that, with proper precautions, men in health can endure, for whole months together, a temperature of 40, 50, or even 60 degrees below the freezing-point of water. Whilst as regards man's endurance of great heat, to say nothing of his subsistence in high health and strength under the very Line, the experiments of Sir Charles Blagden and others have proved that a heat of 260°, or more, may be borne for a short time, provided the air be dry and the body at rest. Moreover, the feats of Mons. Chobert and other "fire-kings" show that *some persons* can withstand for a few minutes the scorching effects of air heated to the terrific height of 400°; or, as some assert, to 600°; that is, to twice or thrice the heat of boiling water, and equal to that of molten lead.

The Forces regulating the Animal Heat.—The power by which the heat of the body is mainly regulated resides in the nervous system. Nevertheless, this is only true as regards ourselves and the higher orders of animals, for some of the lowest tribes of the animal kingdom exhibit no trace of a nervous system, and yet they maintain a temperature considerably

above that of the medium in which they live. Indeed, we know that the juices of trees and vegetables, in which no structure possessing the functions of a nervous system exists, are preserved in a fluid state under a freezing atmosphere; and in winter their internal temperature is proved by the thermometer to be in excess of that of the surrounding air. The opposite effects of too great solar heat are guarded against in the ease of vegetables, as they are in animals; viz., by transpiration through the leaves and stems, which is equivalent to the perspiration through the skins of animals.

The sources of animal heat lie deep down amongst the recondite phenomena of nutrition and secretion; they are supplied by the food we eat, and the air we breathe. The normal state and activity of these forces depend upon the integrity and proper nourishment of the brain and nervous centres. Those persons who enjoy a good digestion, and are possessed of vigour of body and mind, by evolving a large amount of animal heat, exhibit the highest powers of resistance to the effects of great heat or cold. The same is true as applied to the minor degrees of variability of temperature occurring in our own climate. Robust people, with good digestive powers, and, as a consequence, with good circulation, may go about thinly clad in severe weather, which would be most dangerous for persons of feeble powers of life to do. Let no one lay down laws for the guidance of others from his own feelings. *Those feelings are only his own so long as his bodily functions are performed in the same manner:* rules deduced from them cannot be applicable to others whose vital machinery may operate with an entirely different degree of force.

Moderate cold is better borne than *great* heat by people of this country, and by the Anglo-Saxon race in general. What is the cause of this? Is it not

the result of their having dwelt for ages in a cold and damp climate, yet one which is not subject to great extremes of temperature?

Comparative Healthfulness of Hot and Cold Weather. —The prevalent notion amongst the less reflecting portion of the community undoubtedly is, that hot weather in this climate is relaxing, and therefore unhealthy; and that cold weather is bracing, and therefore the more healthy of the two. We shall presently show the entire untruth of this notion, the great prevalence of which is difficult to be accounted for. It is clear that it is not possessed by the natives of warmer climates, who invariably suffer by removal to the colder and moister countries of the north. The belief alluded to is also unsubstantiated by the statistics of health and disease, and the registers of death amongst ourselves. It is quite notorious that sickness prevails much more generally during the winter and early spring months, than during those of summer and autumn. The books of every hospital and dispensary in the kingdom will bear out this assertion. With regard to children, the aged, and habitual invalids, this truth is still more salient. In addition to these prevalence of the erroneous notions respecting warm and cold weather, and which are contradicted by the statistics of health, disease, and death, there are many false impressions still remaining upon the minds of the unscientific public, as to the effects of heat and cold upon the various functions of the body. The belief that life is more vigorous and the system more active in cold than in warm climates is one of these: yet is this idea as unfounded in fact as the one which has just been adverted to. There is no fact in physiology more certainly established than this: that *warmth* and the *light* which accompanies it, stimulate the functions of both vegetable and animal life to a higher degree of activity than

they can attain to under the action of cold; and, indeed, that without considerable temperature they are unable to culminate to their highest perfection. To come to examples: animals of the same species are almost universally more dwarfish in cold than in warmer latitudes; and this is especially the case with regard to those animals—as the horse, the cow, the sheep, and the dog—which accompany man in all climates. The human race itself is dwarfed after passing out of the northern temperate into the frigid zone. The Fins and Laplanders, in Europe, and the Ostiaks and Kamtchatkadales, and other inhabitants of the northern parts of Asia, are examples. The same is true of vegetation generally. Heat, in fact, is the great stimulant to growth; and it is during summer that the vital functions acquire their greatest activity, and the powers both of the body and mind their highest development. It is not pretended that cold weather has not its uses. Cold hardens the tissues which have been formed during the heat of summer. It dries up the superfluous juices; and, in the vegetable kingdom especially, conduces to that repose which the conditions of the globe impose upon that portion of living beings.

Another erroneous notion very prevalent amongst the active and the healthy is, that because cold excites to increased exercise, and that exercise to increase of appetite, it must be more supporting to life (human life) than heat. But, if tested by facts, this idea is as baseless as the foregoing. Physiology tells us that the vital functions are more sluggish in cold than in warm weather. The circulation is slower; the respiration also; and the transpiration through the skin, one of the most important of the bodily functions, is reduced to a minimum. It cannot be doubted that the nervous force is also less active in cold than in warm weather and climates.

Excessive cold is a negation of all life, and coldly temperate climates are but a few degrees removed for the better. Congestive diseases, scrofula, and consumption commit their greatest ravages in cold and damp climates, and in cold weather in the more temperate ones. The warmth of summer tends to dissipate these congestions of the glandular system, by exciting secretion and removing effete and morbid matter. This position is further supported by the great amount of sickness which generally supervenes in the autumn or winter following a cold summer. In fact, every season has its proper range of temperature; and the nearer each approaches to its typical condition, the higher, *cæteris paribus,* will be the general standard of health. In the animal as well as in the vegetable frame, there are distinct effects to be produced by each change of season. Heat excites growth and change of tissue; cold hardens and consolidates the new material; and as each season arrives, those cyclical changes which go on in the body, some weekly, some monthly, some yearly, and some only in a term of years, look for the atmospheric influences which are most conducive to their normal performance. Hence, except for a temporary purpose, and to modify some already existing abnormal action of the body, it is a mistake to suppose that a removal to a climate where the temperature varies within the very smallest range will prove beneficial to the health of English people. Whether it be from habit, or, as already hinted, that a variable climate, and one in which the range from summer to winter is moderate in extent, is absolutely the best, experience proves that nowhere on the face of the globe is the health of the Anglo-Saxon race so well preserved as in these kingdoms. The temperature most congenial to the feeling of the majority of persons in this climate ranges from 60 to 70 degrees.

A lower temperature than this is very enjoyable, provided active exercise can be taken to generate an atmosphere of warm air immediately around the person. Indoors, and at rest, most people feel chilly when the mercury falls below 60°, and some people cannot well bear it below 65°. In winter, it is not easy to maintain a higher temperature than this, consistently with good ventilation. In summer 70° or 75° indoors is not oppressive; beyond this it becomes so.

We are now to consider the effects of temperature under two practical aspects—viz. that of clothing, and that of choice of residence as regards climate.*

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* The material well-being of the people of this country, enabling them to obtain a sufficiency of food, clothing, and shelter from the weather, together with the absence of extremes of heat and cold, appear to have given to them a plumpness of person and a delicacy of skin which together make up so much of what is commonly reckoned as physical beauty. Whether it is a prejudice arising out of national vanity or not, we doubtless believe that these characteristics entitle us, as a nation, to be considered to excel most, if not all others, in that quality. Even our neighbours, the French, allow the justice of this assumption so far as the female sex is concerned. That these circumstances play an important part in the production of a handsome exterior is no doubt proved by what takes place when our countrymen go to climates differing very materially in character from their own. They do not stand the heat of those climates well. The muscular system is found to waste, the fat is removed, the skin shrivels, giving an appearance of premature old age. This is more readily observed in females, whose natural plumpness is the first thing to fail. Organic diseases, too, commit great ravages amongst them. Our descendants in America have diverged very much indeed from the original standard in the above respects: they have become more lanky, and their skin is browner and drier, and they put on an appearance of age, especially the women, quite prematurely.

Notwithstanding the foregoing, competent observers of the physical characters of different races and nations assert that this handsome appearance of the English females and people is, after all, only skin deep, or, at most, dependent upon a certain amount of *embonpoint*. The whole of the Germanic race—British, Danes, Dutch, Germans proper, and particularly the natives of Saxony—all present gradations of the same type of exterior conformation.

SECT. I. CLOTHING.

The object of clothing is twofold. In the first place we have to prevent, in the readiest and completest way, the abstraction of heat from the surface of the body more rapidly than it can be generated without exhausting the vital forces. The temperature of the surrounding atmosphere being almost always below that of the body, we have to diminish, as far as possible, the radiation of our animal heat into space, and thus save the vital chemistry which generates it from too great a demand upon its powers. The second intention to be fulfilled by clothing is to protect the delicate and sensitive skin from dirt, wet, and other hurtful things, and to shroud it from the direct rays of the sun.

There is nothing like going to first principles when we propose to inquire how we ought to act in order to ensure certain definite results. The proper amount

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This type consists in flaxen, light-brown, or auburn hair (in the time of Tacitus the hair was more or less red), a fair skin, and a good deal of plumpness of person. They are deficient, however, in the firmness of muscle and distinctly-defined feature, which give character to the motions of the body, and expression to the countenance of more southerly people. In fact, the *embonpoint*, consisting, as it does, of increased development of the fatty and cellular tissues under the skin, by giving a universal smoothness to the surface, tends rather to erase those irregularities of feature and limb which a higher muscular tone and action give to the inhabitants of more southerly nations. Artists dwell with rapture upon the finely-turned limbs, the lithe and elastic bodies, and the more sharply-cut features which altogether give an air of spirituality and grace to the women of Spain and Italy. We should, therefore, probably err in attributing the whole of the great differences between the physical characters of the northern and southern people to conditions of climate alone. Much is due to peculiarities of race also; but even if the Germans and English do owe their smooth skins and plump persons to material well-being, aided by a cool and moist climate, the Greeks, Italians, and Spanish may claim, from their large descent from the old Hellenic race, the finer qualities of grace of form and motion, with a more spiritual expression of countenance.

and kind of clothing will be found to depend upon the fixed laws of heat, on the one hand, and upon those of vital chemistry on the other.

Means of Preventing the Escape of Animal Heat.—It is in winter that the too rapid escape of the heat of the body has chiefly to be guarded against. The rapidity with which the animal heat *tends* to escape from the surface of the body depends upon the difference between the temperature of the body and that of the surrounding air at any given time. The rapidity with which it *will* effect its escape must depend upon the means which the *colour* and *texture* of the clothing may afford for conducting it from the surface into the mass of surrounding air.

The laws of physical science tell us that heat passes from one body, animate or inanimate, to another in three modes—viz., 1st, by convection; 2nd, by radiation; 3rd, by reflection. We have an example of the first mode when we place the end of a poker in the fire, and, holding it by the other end, feel the heat conveyed to our hand along the intervening mass of metal. All bodies convey heat in this way, and therefore our clothing does so; but it depends upon the texture of bodies whether they convey heat quickly or slowly. A solid body, like iron, conveys it with great rapidity; those of looser texture, as wood, woollen articles, &c., much more slowly. By *radiation* is meant that heat passes off in rays diverging from the whole surface of luminous and heated bodies. This is the way in which heat reaches us from the sun, and from fires, candles, &c. The rapidity with which radiation is effected depends more upon the colour and nature of the *surface* of bodies than upon that of their texture. Rough surfaces and loose textures radiate more rapidly than smooth and dense materials. By *reflection*, heat, like light, is thrown back unabsorbed from the polished and light-coloured surfaces of materials of high density,

as from white walls and roads, and from the polished surface of steel grates, &c. In this respect reflection of heat follows the same laws of incidence which obtain in the case of light.

Now, in this view, the quantity of clothing required at any season of the year will of necessity be regulated by the kind and colour of material used in its manufacture. We shall probably find here, as in many other instances, that our scientific explanations will only confirm the justice of the deductions which common usage has drawn from common experience. Like Mons. Jourdan, we shall probably learn that the fine doctrines of the schools may, after all, be couched in the plain prose which we have been unconsciously using all our lives. But even this is not without its satisfaction, for it puts an end to quibbling and conjecture, and furnishes us with *points d'appui* whereupon to push our investigations further.

Under-Clothing.—The great distinction between the clothing of savage and semi-savage nations and that now adopted by all civilized people of temperate climes, consists in the use, by the latter, of some kind of under-clothing distinct from their upper garments. Even the ancient classic nations were much behind the moderns in this respect. The tunic and toga of the Romans by no means corresponded to, or subserved the same uses, as our under and upper garments do. No doubt the warmth of the climates in which most of the civilized nations of antiquity lived, rendered this distinction less necessary; and the frequent bathing and anointing of the skin practised by them secured, in some measure, the removal of condensed secretions from its surface.

For any useful discussion, then, we must divide clothing into two parts, the under and the upper garments, inasmuch as they are intended to serve two distinct purposes.

The purposes of the under-clothing are, first, to prevent the too rapid escape of the animal heat; 2nd, to conduct the moisture contained in the sensible and insensible perspiration to the outer air; 3rd, to catch and retain within it the animal matters which transude along with the water of perspiration. Note here the significance of the word *perspiration.* It means a *breathing through*, a respiration, in fact, by the skin, just as the lungs breathe through the delicate membrane which lines their minute cells. The products are, in each case, carbonic acid gas and watery vapour, to which is added, in the case of perspiration, a peculiar animal matter, the retention of which in the system would give rise to serious evils. In order to prevent the natural heat of the body from passing off too rapidly, a texture is required which shall *convey it slowly*, and *radiate* it with difficulty. To perform the second indication, it must possess facilities for the passage through it of the moisture of perspiration; and to effect the third, the material must be such as will hold the animal matters entangled in its meshes.

The best Material for it.—Woollen materials of loose texture are well known to convey heat more slowly than any other substance now in use for under-clothing. The rougher the surface, the more difficulty will there be in the passage of heat by convection. *Flannel* next to the skin is therefore to be preferred to any other material, in a general way, for those who do not generate heat rapidly, or who feel chills readily. The flannel may be fine or coarse in proportion to the peculiarities just named. Moreover, in damp and cold climates, this, or some other material having like properties, is essential to health in the colder months of the year. *Cotton* forms the next best material for the same purpose. If worn in winter, it should be thick and of loose texture,, whilst in

summer a finer fabric may be used. These two are the *only* substances fitted to be placed next the skin in our northern latitudes; and there are good reasons for their retention whenever the inhabitants of these regions proceed to a warmer climate.

There are, however, some persons whose skin is so delicate and irritable, that woollen material of any kind next the skin is altogether insupportable. For such persons spun-silk has been recommended; but it is objectionable on account of its exciting properties, and of the closeness of its texture. Fine cotton must be substituted in this case, and the want of sufficient defence supplemented by increasing the outer garments.

For Females.—These observations must be somewhat modified in the case of females. Women, especially those of fair complexion and sanguine temperament, possess a much greater delicacy of skin than the opposite sex. Their nervous expansion is greater, and consequently the effects of irritation are more readily and keenly felt. The perfect smoothness of surface and absence of hair, together with the tight ligatures they use around the middle of the body, cause their clothing to adhere more closely to the skin, and, by friction, to excite perspiration more readily than is the case with men. This is the reason why ladies do not like flannel, except it be of the finest texture, next the skin. Moreover, for females of the more comfortable classes, not much exposed to vicissitudes of weather, flannel next the skin is not required, except in cases where chest affections are to be feared, or where there is much susceptibility of the mucous membranes. It becomes, in some cases, positively injurious by retaining too much heat about the central parts of the body, where it is closely confined by stays and ligatures. A light mixture of fine wool and cotton, or cotton alone, is best suited for such persons.

Objections to Under-Clothing.—There are yet existing some few persons who not only persist in retaining the old linen shirt next the skin, but who conscientiously believe that the use of flannel undergarments has made the present generation more susceptible to the vicissitudes of weather, and therefore increased the number of victims to catarrh, bronchitis, consumption, and other diseases. It is not easy to reason these gentlemen out of their prejudices, or to make them see the *non sequitur* of their reasoning. They hear more of these diseases than formerly, no doubt. The public have got to use, with tolerable correctness, too, the scientific names of diseases and symptoms of disease; and as people are fond of exaggerating the magnitude of their disorders, calling a common cold bronchitis, and the like, there is a greater *sound* of chest complaints than formerly. The *experimentum crucis*, however, is to be found in the archives of the Registrar-General. He tells us that the deaths from these diseases have diminished very considerably within the period since the general introduction of under-clothing. The same gentleman also tells us that the average length of life in these kingdoms has been increased within the last few years by no less than *five* years, and within the memory of the "oldest inhabitant" by even more than that. What an increment to the average duration of human life is this!

To what circumstance will our old-fashioned objector attribute this beneficial change? What is there that can have effected such an improvement in the health of our population if it be not purer air for the lungs to breathe, and greater care of that important organ, the skin, by means of better clothing? Food is here left out of the question, for it is not certain that much of the improvement in the general health can be attributed to any change

in diet, further than what is due to the gradual reduction in the consumption of intoxicating drinks. Suppose we were to reverse the present custom as regards under-clothing, aud revert to linen next to the skin. What would be the result? The insensible moisture of the skin would be condensed upon its surface; the evaporation of the fluid there formed would require the abstraction of a great deal of the heat of the body, which would give rise to chills, and frequently lead to internal congestions, inflammations, and death. If what has been said at the beginning of this work possess any truth at all, it consists in teaching that *the purification of the body by means of the lungs and skin is the most essential of all the functions*, and without it, growth, the deposit of new materials and the removal of the old, which constitute the essence of life, become impossible. In a country like ours, three-fourths of whose inhabitants, from their laborious habits, so sadly neglect the cleansing of their skins by bathing, &c. the use of flannel affords a partial substitute by removing, by way of friction, a good deal of the dust and other matters which adhere to and close up the pores of the skin.

Outer-Clothing.—The principles which should guide us in the selection of our outer coverings differ somewhat from those which regulate the choice of under-clothing. In the latter, the object is to retain the heat of the body; or at least to prevent its too rapid escape. Outer clothing, in addition to assisting to retain animal heat, has other offices to perform. Thus, in temperate climates, or in those rather cold than temperate, and in cold weather everywhere, one purpose which outer garments serve is to absorb heat from the sun's rays. Another is to resist the entrance of water, or of damp air. In warm climates, and during the warmer

season of temperate ones, the former object is reversed, and a material is required which shall at once allow of the escape of the heat of the body, and prevent the absorption of that of the external air. These several requirements necessitate the consideration of the *colour* and *texture* of the various materials used for outer garments.

Colour in Relation to Clothing.—A good deal of confusion still exists in men's minds as to the principles upon which the colour of clothing should be chosen in hot and cold climates, or, what comes to the same thing, in hot and cold weather, respectively. The negro is said to have been endued by nature with a black skin in order to keep him as cool as possible. Black quickly radiates heat, provided the surface of the body radiating be rough or uneven. But the negro's skin is smooth and polished, and therefore a bad radiator. Then black absorbs heat from the sun much more readily than lighter colours. What scanty clothing decency induces the negro to put on is generally of *white* linen or cotton. White radiates heat badly, and absorbs little or none from the atmosphere. A perfectly white covering would therefore be the coolest wear for him. But what then is the rationale of the black skin? This—the heat of the climate is sure to prevent the inhabitants of the torrid zone from wearing much clothing. Under these circumstances, had the negro's skin been fair, like that of the European, it would blister and inflame every time it was exposed to the burning rays of the tropical sun. This fact is apparent from the readiness with which, in this climate, persons of fair complexion freckle and blister compared to the immunity in this respect enjoyed by persons of dark hue.

Although I cannot find any other solution of this question than that here stated, and which agrees with the known laws, both of physiological and of

physical science, objections have been made to it to the effect that the colour of animals in the Arctic regions contradicts it. It is well known that in high northern latitudes, most of the animals—bears, foxes, and the like—are either always more or less white, or become so on the setting in of winter. This would seem to establish the paradox that white is the best covering to secure warmth in winter, whilst we have just assumed it to be the coolest wear in summer. This apparent paradox, however, is easily explicable by paying attention to the real facts of the two cases. The white winter covering which some animals assume is only found in very cold high Arctic regions, where, in winter, there is no sun at all to give any external warmth. There, the sole object of clothing must be to retain the animal heat, as there is no hope of absorbing any from the atmosphere. Therefore, a colour which will *radiate* least is what is wanted, and that colour is white. In more temperate climes we find that wild animals retain nearly the same colour in winter as in summer. At the Equator, a colour of skin which radiates most, viz.—black, and an outer garment which absorbs heat the least—white, is demanded; and thus it comes to pass, that white garments are warmest at the poles and coolest in the tropics. The application of this fact tells us that in extremely cold weather, of Arctic severity, in this climate, a white overcoat will be found to be the warmest.

The colour of the outer-clothing is by no means a matter of no importance in this varying climate of ours, and the facts just stated will serve to guide us in making a selection which shall have a natural relation to the changes of season and temperature. If we place a piece of black and a piece of white cloth upon the snow, on a winter's day, when the

suu is shining brightly, it is well known that the snow will melt rapidly under the black, but will be scarcely affeeted under the white. If we stand still in a sunny place out of the wind, in winter, with a black coat on, we soon feel the genial rays penetrating through the cloth to our skins. If with a white coat, this is not felt. If we do the same thing in summer we shall be broiled in a black eoat, whilst in a white one no ineonvenience is felt. The prineiple evolved from these facts is, that as we require to absorb heat from what little sun we have in the winter, without dissipating that of the body by radiation, the outer garment should be of black, or other dark colour, with *white* under-clothing. The rule is applieable with still greater foree to the ease of invalids, children, and old people, and all those who, from constitutional peculiarity, are unable to generate a suffieient amount of animal heat. The prineiple here laid down need not be so rigidly carried out withiu doors, at least in houses where plenty of warmth can be secured. Indeed, light colours are often to be preferred in the house, as they absorb less of the heat and glare of fires and lamps.

The general remarks which have just been made upon the subjeet of outer-clothing, apply with equal force to the dress of women as to that of men. It is true that women wear a larger quantity of warm uuder garments than men generally do, and so far, the eolour of the dress is not quite so important a matter as the texture, of whieh I shall presently speak.

Texture of Materials.—One objeet of clothing is to retain a layer of warm air near the skin, so that the external air, in its eontaet with the body, may be warmed by it, and its ehilling effeets thereby mitigated. Thiek, fleecy garments hold a good deal of air entangled iu their meshes, whilst fine and smooth

extures retain but little. The quantity of air thus etained in the clothing is increased, to some extent, y multiplying the number of layers of which it con-ists. Thus we may have the under-clothing, consisting f a flannel or cotton vest and drawers, then the shirt, which in winter should be of fine wool, the waistcoat nd body coat, forming a series of layers with three nterspaces between them; and if a top-coat be added, vith four. Now these spaces are filled with air at a emperature ranging from that nearly of the body tself to one approaching to that of the external at-nosphere. Some persons find that they can retain he warmth of the body most effectually by placing everal thin garments one over the other, instead of ising a smaller number of thicker material. I have nown a person wear three flannel vests, one over the ther, of different degrees of thickness, with a shirt vith open bosom, and a single light coat over all, and leclare that he was warmer thus in the coldest weather han he would have been had he worn the usual mount of under and upper clothing, with a thick op-coat in addition. I have no doubt but that several ight garments of loose, rough, fleecy texture, would e found to keep out the cold more effectually than smaller number of thicker coverings. There is this bjection, however, to loose thin garments in cold veather. Their loose fit admits of the cold air eadily getting in amongst them, and so reducing the emperature of that layer which is nearest the body oo rapidly. Therefore, for cold, windy weather, a ight-fitting overcoat affords the best protection by ompressing the warm air close to the body, and eeping it there. Cloaks, which are the type of a oose flowing outer garment, have seldom long retained heir hold upon fashion in this country. They are pen to the objection just mentioned, and are not so vell suited to our active habits. For the Spaniards,

Italians, and other residents of more temperate climates, whose habits are more sedate and sedentary than ours, they are as well suited as they are customary.

Of late years, it has been the fashion to wear the outer garments, whether the body or the overcoat, of loose texture, and of long hairy materials; the old fine cloth great-coat having gone much out of fashion. There are some advantages in this change; a larger area of meshes being included in these textures, the heat is kept entangled in them, and consequently is carried away by *convection* much more slowly than it would be in the case of a denser material.

In winter, besides proper under-clothing, it will be always advisable to wear an extra garment of some sort whenever the temperature falls below 50°; or, in the case of delicate persons, 55°. And when active exercise renders this irksome, it will be best to have an overcoat ready at hand to put on when the exercise is terminated. Nothing is so detrimental to the health as an *abiding feeling of cold, or chilliness.* Whatever the weather or the place, in-doors or out, this feeling, if long continued, is certain to give rise to disorder of some function of the body. There is not the same amount of risk in a person going from a hot room into the cold air without precaution for a *few minutes*, as there is from remaining long in the open air, however well clothed, if there is a continued feeling of chilliness. Reaction will take place readily enough in the first instance, on returning to the warmth; whilst in the second, the length of time that the blood has been repelled from the surface, produces colds, with bronchial or other inflammations.*

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* Notwithstanding what has been said above respecting the exploded doctrines of hardening the system by exposure to weather without what is now considered to be a proper amount of under-

Clothing of Children.—It should never be forgotten by those who have the care of children, that of all ages, that which resists cold the least, and suffers from its ill effects the most, is early childhood. The temperature of children is some degrees lower than that of adults. From early childhood to adult age, the capability of resisting cold increases, remains nearly stationary during the prime of life, and diminishes towards old age in about the same ratio as it increases in early life. There are certainly some old men who apparently resist the effects of cold as well as the young, but these cases are rare. They are generally found amongst those who retain their fresh-

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clothing, it must be conceded that the skin, by careful covering, especially with flannel and other exciting textures, does become more sensitive to change of temperature and to painful impressions generally. This is owing to the higher development and greater activity of the functions of the skin which it acquires under this management. The wearing of gloves gives to the hands greater delicacy of touch, of veils more softness and smoothness to the face, and of flannel and other warmth-promoting tissues, higher sensitiveness to the skin generally. But what of this? or can it be helped? The daily-increasing numbers of persons whose employment keeps them in-doors all day under a comparatively high temperature, make up a large portion of the population, all requiring, when out of doors, a greater amount of clothing in consequence of the diminished strength of their circulation caused by an in-door life. Moreover, even amongst the hale and robust inhabitants of the country districts, the increase of comfort and luxury (of which warm rooms form a great part) in their dwellings, calls for a greater amount of protection when in the open air.

This increased sensibility of the surface of the body, perhaps of the body generally, is therefore an effect of the general progress of civilization in modern times, and of the higher nervous tension which is brought about by its means. Further, the use of tea and coffee, of light wines, and of other drinks which excite the mind and sensorial system, in place of those heavier stimulants to the vascular apparatus which were formerly exclusively used as beverages, and whose first effects were violently to excite, whilst they afterwards blunted the faculties of sensation and perception, has also contributed a large quota to the result now under discussion. For all these changes in the state of the nervous system consequent upon a higher degree of cultivation of the sensibility of the surface, there is a remedy, and that remedy is one the use of which argues a higher

ness and vigour of body far into what is called a green old age.

The covering used next the skin of very young children should be of *cotton;* never, except in peculiar cases, of *flannel.* Over the cotton, a fine flannel may be placed. When the child arrives at an age to take vigorous exercise, the flannel may be put *under* the cotton shirt, but not till then. Some persons have a fancy for coloured flannels; they are not so warm, for under-clothing, as white. The clothing of growing children should be loose and free, and absolutely devoid of any tight ligatures round the throat, the chest, or the knees. Every joint must have full room for play; and no artificial support or bandage should on any account, except in special cases under medical supervision, be applied to any portion of the body of a healthy child. Bandages round the abdomen, and stays round the waist of either sex of children, are an abomination. Laying

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degree of rational endowment than was exhibited by our naked forefathers, or even by the cultivated nations of classical antiquity. The proper apportionment of under-clothing to the season of the year, and to the peculiarities of situation in which each person finds himself, will meet all the supposed evils which have been adverted to, whilst its manufacture gives employment to thousands of persons who, but for these quasi-artificial demands, would never have been called into existence.

Another circumstance, always overlooked by those who argue for a return to the old-fashioned neglect of the surface warmth, is to be found in the great advance in mental activity, and in the cultivation of those arts which minister to a refined sensuousness of the eye, the ear, and the other senses. Music, the arts, and accomplishments of all kinds, excite a higher sensibility of the brain, and this entails along with it a corresponding exaltation of the whole nervous system, of which that of the skin is so material a portion. If this be so, it follows that we cannot return to the ancient style of dress if we would; nor dare we, as formerly, let in the wind by a thousand chinks into our dwelling-houses. Civilization, as a whole, is a continued changeful progress (whether always in the way of real improvement, cannot here be discussed), and the various habits which combine to make up the idea of civilization are all more or less tied together by natural bonds which cannot be severed.

aside the pretended improvement of the figure, the only use of stays must be confined to supporting the weight of the bosom, and can only be required, except in cases of great obesity, by mothers. Where, then, is any rational pretext for putting them upon children, or indeed upon girls of any age, except in the rare instances just mentioned ?*

SECT. II. CLIMATE AS REGARDS PLACE OF RESIDENCE.

The effects produced upon the constitution, by the atmosphere of towns, and of country districts respectively, have been already adverted to in the chapter on air. The popular notions of climate appear to have regard chiefly to the differences in temperature, together, perhaps, with that of the rainfall in various places, rather than to the purity or impurity of the atmosphere. Thus, we speak of the climate of the South or of the West of England, of the South of France, of Italy, &c., mainly with reference to their respective temperatures. Writers on this subject also content themselves with ascertaining the *mean* temperature of one

* The principles enunciated by the late Sir G. Cornewall Lewis, in his thoughtful work "On the Influence of Authority in Matters of Opinion," may be transferred to the subject here under discussion. Certainly the folly with which mothers who, in most other respects, exhibit a sufficient degree of the reasoning faculty, yield up the bodies of their infants to the tender mercies of ignorant midwives, whose principles of clothing new-born infants seem to have been borrowed from the Hottentots or the squaws of North America, is only equalled by their slavish adhesion to fashion in the clothing of their children when of riper years. Who that has seen on a cold and windy winter's day, these poor martyrs with their naked red or blue legs protruding from under petticoats and crinoline whose shortness is proportioned to their amplitude, but has asked himself how the mother would relish either the exhibition or the freezing cold ? When even Highland regiments have been obliged, by disease, to lay aside the uncomfortable (if picturesque ?) kilt, what can these mothers mean by subjecting their children to the same serious evils at an age when they are entirely unable to resist their effects ?

place of resort as compared with that of another, the prevailing winds, amount of rain-falls, &c. There is such endless diversity in these respects amongst the more fashionable places of resort, that their determination, has become a branch of science of itself, having its foundation in meteorology. It will therefore be impossible to advert, in this place, to the climate of all the different places which are resorted to either for health or recreation; but those which are situated in our own country will be presently adverted to for the benefit of persons who are on the look out for the means of deciding upon their place of residence either temporarily, or for a permanency. For further information, there are many good works on the subject of local climate which may be consulted with advantage; always remembering that each writer generally lauds the place of his residence or choice in terms rather beyond its real merits; whilst we may be pretty sure that his local knowledge of the subject must be more trustworthy than that of a stranger.*

I have already stated that physiology teaches us that every season has its beneficial action upon the animal frame, and that an uniformity of temperature and of skies would be as unsuited to health, as it would be monotonous and wearisome to the mind. Heat and light stimulate growth, and the increment of the body; which cooler weather tends to consolidate. Winter is the time in which the least change is made. Children don't grow so fast in winter as in the spring and summer months. Cold weather, then, has for one of its uses the causing of a certain degree of vital inaction, a kind of annual sleep, corresponding in some respects with the diurnal.

* The works of Sir Jas. Clark, Dr. Granville, and Dr. Edwin Lee, on the subject of the climate of watering-places, may be fully trusted.

Winter.—To those who have it in their power, or whom the search after health requires to change their residence according to the season, the following rules may be of use. Above all things choose a dry situation, one if possible where the rainfall is small, but, what is of more consequence, where the soil is light and porous, and the drainage of the *neighbouring land* good. Invalids and weakly children are particularly liable to be detrimentally affected by the damp stagnant air of a badly drained country. Large trees near enough to a dwelling to cast a shadow upon it are injurious. Some portion of the walls will certainly be kept damp by them, and the free circulation of the air will always be impeded wherever the rays of the sun cannot penetrate. The paper and furniture of that part of the house which is shaded will show signs of damp and moisture, which is slow decomposition. A continuous slight amount of damp in the walls or roof of a house is pretty sure to engender rheumatism, neuralgia, or glandular enlargements. Nothing is so bad as an abiding sense of damp or cold. Houses built of brick rather than of stone are to be preferred, particularly in damp situations. As regards locality, Hastings, the Isle of Wight, Torquay, are perhaps the best for invalids; and Leamington, Malvern, (which, though not yet fashionable in winter, is an excellent winter residence for healthy people, being very dry), Tunbridge Wells, or London, will be suitable neighbourhoods for the healthy and robust.

Spring.—The principal points to be attended to in spring are freedom from excess of moisture, and, as much as possible, from east and north-east winds. In spite of Mr. Kingsley's animated apostrophe to the Nor'-easter, I will repeat the caution already given respecting them. Get out of their way altogether. Go anywhere, but avoid them if it

be possible. The great requisite which a spring residence should afford is a provision for out-door exercise. After the close confinement of the long winters of this climate, invalids and delicate persons feel an absolute necessity for change. It is therefore that a dry soil and good drainage of the neighbouring land is so essential a point in the selection of both winter and spring residences. After all, perhaps a town residence has the balance of advantages in its favour for the earlier spring months.

This opinion by no means justifies the fashion which keeps such a large proportion of the wealthier classes, old and young, in the heat and turmoil of London, not only during the best spring months, but far into those of the summer. This fashion, so often derided, is no doubt founded upon some of the oldest customs and thoroughly ingrained habits of the English people; and it would therefore be hopeless to engage in a crusade against the *London season.* The hospitalities of Christmas, the prevalence of field sports—shooting and hunting—by keeping the gentry in the country quite up to early spring, tend to throw the London season far into the year before it is completed. Then the exigencies of Parliamentary life, which again depend upon those of the country, all fall in the same direction. But there exists no good reason why this season of excitement and of worry should be extended so far into the summer as it is at present. In fact, nothing but the maturity of the grouse seems capable of setting any limits to its duration. The season begins and ends earlier on the Continent than with us, and the most beautiful and enjoyable portion of the year need not there be wholly spent amid dusty streets and crowded assembly-rooms. These remarks are trite enough, and doubtless will be unheeded: the prevailing fashion will always reign despotic until some more powerful potentate is able to depose it.

It must be admitted, however, that it is to commit a grave error, both in a sanitary point of view, and also in relation to the proper healthful training of the mental susceptibilities of young people, to debar them from the enjoyment and benefits of a country life at that particular season when Nature, arrayed in all her virgin prime, invites every sensitive mind to communion with her. It is peculiarly in spring, when nature lavishes with unsparing hand her freshest charms upon every hill and grove, garden and bower, that those feelings, latent during childhood and early youth, which are given for the purpose of enabling us to hold converse with the Infinite Goodness and Power, and from which converse springs almost all that is lofty and noble and unselfish in the bosom of youth, are likely to be called forth. Nor can it be shown that this intercommunion with Nature's works can be excluded from the mind of youth without danger of the gravest results to its moral nature.

Summer.—Where to live in summer, in this climate, happily we need not seek. The healthy may live anywhere. Those who cannot get away altogether from large towns may perhaps get at least one or two short runs to the breezy Sussex downs, to Malvern, Wales, or Scotland; or to places along the eastern coast. All will do—an open country or a bold sea-coast, admitting of plenty of active exertion for the body, and occupation for the senses and perceptive faculties of the mind, will fulfil every indication of health.

Autumn.—Perhaps, after all, autumn is the season in which change is most desirable and desired. It is the season of least business activity: the great arenas of intellectual struggle are then for the most part closed; trade and business of almost every kind languish, from the absence of a large portion of their devotees. The long-continued strain upon

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the vital and mental powers, for life, eminence, wealth, or power, now seeks to be relaxed. The over tension of the nervous system borders upon rupture, and threatens collapse of its powers. The digestive organs, jaded by a long course of stimulating diet, or worse, of hasty meals and ill-selected food, crave for rest and wholesomer meals. All the teeming, and reeking, and languishing population of our great towns, which has never had its harness off for nine or ten long months, cries out for change of scene and place.

Where shall I spend my holiday? Where shall I find the greatest enjoyment with the best means of recruiting health? Shall I, after spending a few days in the museums of Paris, rush down to Marseilles, cross to Alexandria, ascend the pyramids and the Nile, scamper across the desert, get a peep at Jerusalem and the Holy Land, then hasten back to Constantinople, and so, by Trieste or Vienna, cross to the Rhine, see the quaint old Belgian towns, and so home by Antwerp or Dieppe? This wont take long to do. It can all be *done* between the middle of August and the beginning of October! Hard work, however; and as the jaded lawyer, and overworked physician, and muddled merchant, have set their hearts upon a holiday, on which no real work ought to be done, I don't think *doing* Europe and Asia, with part of Africa, in this way, can be said to be taking one's leisure. No. Better to go straight to some well-considered resting-place, and making that a temporary home, a head quarters to diverge from and investigate in various directions, get all the quiet yet gently exciting amusement which can be brought within this focus. Or, if time permit, change the scene as soon as the beauties of the first are exhausted.

But all depends upon the state of health in which people start on their annual excursion. The strong,

who only seek for change of sensation, ideas, or amusement, may go where they list, always with the caution that scampering across the world in a railway carriage, though perhaps the whirl and excitement of travelling may be pleasurable at first, is not rest for either body or mind. It is true that the change and novelty of the scenes through which one is whirled, by stimulating the perceptions, and giving a rapid succession of new ideas, may keep up a perpetual pleasurable excitement of the mind, yet the high pitch to which this is pretty sure to be carried will certainly be followed, either before the journey is over, or as soon as we return to our routine employment, by lassitude of body and ennui of mind, almost as distressing to the feelings as the previous excitement was exhilarating to them.*

Invalids in general do well to pass the autumn months at the sea-side; not necessarily at the same place.

* I cannot refrain from quoting in this place some admirable remarks which appeared in the *Lancet*, August, 1863. The editor is adverting to the absence of all stir in the medical, as in the rest of the world, because "all London is out of town." He cautions the public against turning their annual holiday into a mere change of *work*. "To such we say there is a change which is not rest, and a travel which is no relief. The present system of rapidly passing through continental towns, and experiencing every imaginable inconvenience in order to catch a glimpse of

'Countless stores
Of long-past thought and dear antiquities,'

has little to recommend it to him whose daily habits have been founded in regular hours, moderate exercise, and comfortable fare. It is not well thus to make labour of a pleasure. Yet the chances are that the system will be pursued. Some happy man

'—— in seipse totus, teres, atque rotundus'—

forgetting that sixteen stone is no light weight, and that the balance of power, in such cases, more frequently rests with the will than in the legs—is this moment preparing for a continental walking excursion, to find himself blown at the end of the first stage, with recurring mementos of his foolhardiness ensured to him for the coming winter. We advise these excursions to be left to younger men. Londoners have enough of cities; let them seek the fields

The monotony of the sea, to most active minds so wearisome, soothes the irritable nerves of the weak and invalid; and there is generally change enough, either on the sea or on shore, to give a gentle stimulus to their senses. It is unwise to seek too warm and relaxing a place of resort in autumn for invalids of almost every kind. By a careful selection of place, many invalids may remain at the sea-coast so late as the month of November, in most seasons. Wet autumns, however, should be spent in towns, or in situations where the soil is very dry, to avoid the depressing effects of malaria and of decaying vegetable matter.

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and woods as places to make holiday in, if not to live in and live with. . . . . Perhaps, however, he still feels that being in the country, a system of unceasing *tourage* becomes essential. If so, he commits an equal mistake [with the continental aspirant]. "Sudden and continued exertion on the part of those little accustomed to violent exercise seldom fails to be productive of harm. We know of many instances in which permanent inconvenience has resulted from a want of moderation in such particulars. What, then, is the citizen to do who seeks the country for a change? To give up thoughts of business; to revel in the repose of *mind* and *body* which absence of care and regularity of hours ensure; around him, to study the beauties of nature; within, to experience that calm enjoyment which city life denies. . . . . A complete and perfect change, without undue shock to the habits or system, is that which the Londoners require, and that England amply affords in her lakes, mountains, and seaside homes, to the majority of those whose means enable them to enjoy the privilege. . . . . Many, like the Frenchman who exclaimed, 'Pour moi, j'abhorre les beautés de la nature,' will rather seek the busy throng by the sad sea waves. It is, perhaps, the greater change of the two, more especially if we determine to take advantage of the bathing which the sojourn affords. . . . . Many become suddenly impressed with the belief that a sort of amphibious life was that for which they were designed, and seek for the full benefit of the sea-breeze through hours of indulgence in the delightful waters of the place. This is a mistake. Bathing is, to many, the source of both enjoyment and health when used in moderation. On the other hand, its excess proves far from beneficial, especially to the large class of middle-aged, whose swimming capabilities are not altogether on a par with those of the Champion."

I must beg the writer's pardon for having, for the sake of brevity, omitted several of his very apt quotations.

CHAPTER V.

FOOD.

Sect. I. *Nature and uses of food in reference to growth—Assimilation—Secretion—Bodily waste—Identity of structure with change of material.* Sect. II. *Digestion—Mastication—Deglutition—Action of the stomach on the food—Of the small intestines—Rules for good digestion.* Sect. III. *Food—Meat and drink—Animal and vegetable food—Preference to be given to each respectively—Essential principles of food—*A. *Nutritive qualities—Albuminous—Carboniferous, including oily and starchy substances—Aqueous.* B. *Digestibility of foods—Dr. Beaumont's tables of the digestibility of various articles of diet—Circumstances conducing to it*—C. *Savour. Condiments—Drinks—Use of Drinks—Thirst—Are drinks food?—*1. *Aqueous drinks; Water—Physiological operation of—*2. *Infused drinks; Tea; Coffee—Their active principles—Physiological effect of—Effects on the nervous system—On nutrition—Time for taking—Black tea—Green—Difference in effects of tea and coffee.* 3. *Fermented drinks—Beer, ale, cider, perry, wines.* 4. *Distilled drinks—Their Physiological effects; Upon the intellect; Upon sensation; Upon Locomotion; Upon digestion; Upon Nutrition—Arguments of the teetotallers—On the other side—Alcoholic drinks, beer, wine, spirits, when serviceable—The best time for taking them.* Sect. IV. *Diet and cookery.*

SECT. I. NATURE AND USES OF FOOD.

Many definitions of Food have been given, and much controversy has taken place as to what constitutes it—whether food and drink are essentially distinct, or whether they are to be looked upon as different forms of the same aliment. To avoid misapprehension on the part of the reader, I shall here, *in limine*, define food to be *any substance which can enter into the*

body as a component part of it, and, whilst there, assist beneficially in the performance of its functions.

The use of food in the animal economy is founded upon the essential nature of life. All our ideas of life, so far at least as it is developed on this globe, have been formed from the observation of *change*—change either of the particles composing the living body amongst themselves, which is called molecular motion; or change of place of the whole or part of the body in space—locomotion. When neither of these kinds of motion is discernible, either by the naked eye or by the microscope, we judge that the subject under examination is either not alive, or that its life is in abeyance. Examples of the latter are exhibited by the seeds and buds of plants, the eggs of birds, ova of insects, &c.; and, approximately, by the dormouse, hedgehog, and other hybernating animals, during the period of their winter's sleep. When their appropriate stimuli are applied to any of these objects—air, moisture, and the proper temperature, in the case of seeds and buds, air and warmth in the case of eggs of birds and ova of insects, &c.—motion is commenced, and life is developed. Then is set on foot that beautiful series of motions by which fresh material is attracted to the several parts of the germ, out of which organs are developed, to go on increasing until the whole structure has attained its allotted size and figure. This is GROWTH. Growth is nutritive motion—an assimilation of homogeneous substances to form part of the individual organism. In this sense, and it is the proper one, of the word growth, it cannot be applied, as Linnæus did, to the increase of mineral substances; since these latter, having no parts or organs, only enlarge by the accretion of fresh particles to each other.

We may indeed imagine, although with some violence to our preconceived notions of life, that beings

in some other planet than our own may be capable of performing many of the functions of life without any change in the materials constituting their organisms. We can conceive of locomotion, of thought, and perhaps also of sensation, without any motion of the particles of an organized body amongst each other taking place, without circulation, respiration, or muscular motion. Such a mode of life, however, would be entirely different from anything we see on this planet, and must owe its origin and continuance to some force or forces unknown to us. But with such an immobile creature, there would be no growth, and therefore no youth, age, or death. Such a being would be either elevated into the sphere of spiritual natures, or sunk into a mere mechanical and unconscious physical agent.

Change of Substance.—The necessity for food, then, is based upon the ultimate fact that an organized structure can only maintain its functions of nutrition, sensation, and motion, by a constant change of that material which has been spoiled in the act of performing those vital functions, for other material which brings with it fresh and virgin forces. Every act performed by the body renders some of its atoms engaged in that act unfit for further use. Locomotion wastes the muscles, secretion the glandular organs, and thought the substance of the brain. As the fresh nutritive material, eliminated out of the food we imbibe, is circulating through the bloodvessels, the tissues of each organ seize upon and appropriate to their own structure such substances as they have a special attraction for—bone for bone, muscle for muscle, nerve for nerve. This is ASSIMILATION.

Not only does this constant absorption of new matter and discharge of the old go on during the period of growth, or absolute increase of bulk, but when this has ceased, and the bodily weight remains

stationary, fresh material is still deposited and effete matter cast out; and this with such accurate adjustment and counterbalancing of increment and waste, as to maintain the balance of weight, and the conformity of parts to the usual condition of the frame, with the greatest exactitude : so that those organs of the body whose office it is to secrete and prepare matters for ejection from the system, have to keep themselves in thorough accord with each other, and in subjection to the nutrient forces, so as to make room for new material by the timely expulsion of the old. The lungs, the kidneys, the skin, and the lower bowel, are the organs which perform this important office. The first get rid of superfluous water, which has served its office of carrying solid matters to their destination, and carbonic acid gas. The second carry off the urea, which is formed chiefly from effete muscular tissue, saline matters, and also water. The skin carries away water, with a small quantity of animal matter; and the bowels have their special secretion. All of these organs are furnished with apparatus by which their secreted matters are extruded from the system: and thus are completed SECRETION and EXCRETION, the last of the nutritive functions.

These organic changes, which together make up the function of growth and nutrition, are dependent upon the supply of food which is prepared for them by DIGESTION, a process which takes place within the stomach and intestinal canal. This it is which elevates the determination of the quantity and quality of the food which it is fitting to take into the system, into a science—a science upon which, indeed, depend most of the other sciences; for upon the proper nourishment of the body depend not only its own forces, but also the vigour and activity of the mind. Diet, regimen, and their accessory—cookery—are therefore

to be looked upon as most important elements of a work which has for its object the knowledge of *how to live.*

In forming this estimate of the nature and properties of food, we must not fall into the error which was formerly universal, and still, to a certain extent, prevails; viz., that of regarding solid substances as *alone* worthy of the appellation. As all food enters the blood in a fluid state, we can no longer separate *drinks* from more solid aliments; inasmuch as so long as they are assimilable to the substance of the body, they have as much claim to be ranged under the head of *food* as solid aliments. In this sense, even the air we breathe may be reckoned as food, for its oxygen forms a very essential part of the organism, and without it, no other food would be assimilable at all. The terms *meat* and *drink* more fully mark the mechanical differences between solid and liquid aliment, without implying the error first adverted to.

Bodily Waste.—But it is necessary to look a little more closely into the subject of waste, from which the necessity for food arises. Taking the animal body as a physical as well as a vital structure, it is evident that in the wear and tear of use, it must be subjected to loss by friction, as is the case with every other body in motion. The atmosphere, the rain, heat and cold, all act upon the solid rock, disintegrating its particles, and reducing it to the pulpy, friable soil which covers the surface of the earth. All our machinery loses weight by the friction of its particles; and organized bodies, by locomotion, by the molecular motion of their particles amongst themselves, and in the torrent of the circulation, lose some of their substance in the same manner. It is true that the attraction of cohesion, inherent in all forms of matter, tends to resist this disintegration; but in organized beings this form of attraction has

but little force. The loss of substance, therefore, by ordinary friction would doubtless be very considerable, were it not constantly replaced by fresh material, which is deposited in quantity sufficient to supply the waste.

It is, however, the *molecular* friction, or change, constantly going on in the tissues of the body which creates the greatest waste and calls for the largest supplies. The waste arises from *function;* and is supposed to bear relation to rapidity of action; and the necessary repair should correspond with it.

The quantity of material wasted and ejected from the system within a certain time, as twenty-four hours, has long engaged the attention of physiologists and physicians. It is in order that we may know how to balance this waste by fresh supplies that we are so anxious to arrive at exact data regarding it. Indeed, we have no other certain guide to the quantity of daily food which the system requires, than the estimation of the amount of daily waste, however imperfect and illogical a test this may be thought to be.* Yet the amount of bodily waste depends so much upon the activity of the various functions, that we must expect to find it to vary in

* The chemical physiologist will easily detect here a reasoning in a circle. Who can tell what the normal waste would be under an absolutely correct diet, or who can estimate this diet from data as to waste which we have no means of knowing to be perfectly normal? We eat to supply the waste of our bodies caused by function, and the functions do their best to clear the way for fresh supplies, not only under a natural system of diet, but even when it is notoriously otherwise. In fact, one man remains in health and enjoys, apparently, the full vigour of all his faculties upon a diet which another would consider as little better than starvation. Who shall say that the one would do better by increasing his supplies, and the other by reducing himself to half rations? Nevertheless, so long as no absolutely normal diet can be laid down, it follows that the amount of daily waste which *can* be approximately measured, must be our chief guide in introducing fresh supplies.

every individual according to his habits, temperament, constitutional vigour, and mode of life. It remains, therefore, that all calculations of waste made from these data, must be taken as a mere average, and as approximative only, when applied to individuals.

The channels by which waste or effete matter leaves the body, have already been adverted to. The condition also of the secretions is sufficiently well known to excuse further allusion to them. They are solid, liquid, and gaseous. Carbonic acid gas alone makes up the principal portion of this material. By the kidneys, about an ounce of solid animal matter, chiefly urea, and about another ounce of salts, are discharged in twenty-four hours. The perspiration of the skin carries off a small amount of animal matter, with a large quantity of water, and a trace of carbonic acid.

If the water which is set free from the body by means of the lungs, skin, and urine, be looked upon as waste material, then from five to six pounds of fluid must be added to the small quantity of solid matter daily wasted. It is impossible to give, with any pretence to accuracy, the quantity of water which each organ discharges in twenty-four hours, so much depends upon the ever-varying circumstances of bodily exertion, the quantity of drink, which stimulates the kidneys in preference to the lungs or skin, the hygrometric state of the atmosphere, and the temperature of the season. Moreover, these functions are vicarious of each other—that is to say, in health, each readily takes part in the duties of another, when, from any cause, it becomes inert or lethargic.

Identity of Structure under constant Change.—One of the most wonderful circumstances presented by the whole range of physiology is the manner in

which foreign substances are taken into the body, and adapted to its various structures under the dictates of a chemistry so refined and recondite as hitherto to have escaped, in its *ultimate* processes at least, the searching eye of science. Not only is the normal structure of the body constantly renewed, but even blemishes, scars, cicatrices, nay, even diseased formations, are regularly removed and restored. So that, although every particle is changed, the peculiarities of the old material are so faithfully impressed upon the new, that the identity of form and character is never lost nor obscured. The Ego, the conscious self, remains the same, although every atom of material which composed the bodily organs, or which enabled the mind to operate a few weeks ago, may now be replaced by fresh matter. To use a homely simile, our bodies are like the Irishman's knife, which having had several new blades, and at least one new handle, was yet the same old knife as ever.

Whence comes that wonderful force which enables the embryonic germ to build up, out of whatever suitable material comes within its reach, a frame possessing throughout the type or pattern originally impressed upon that germ by its parent, conveying through several generations perhaps, the peculiarities of form, of expression, and of character, which marked the antecedent progenitors? Do we not here find a cogent argument against the doctrine that all living action is but the result of some force *inherent* in matter, or of a modification of the ordinary physical forces, which, on the application of the appropriate stimuli, exhibits all the varied phenomena of life? The doctrine of an unconscious vital principle, of an immaterial substance endowed with certain qualities and powers, using matter as its agent, yet ignorant of all purpose, is now wisely

abandoned by physiologists as inconsequent and illogical. Such a principle, to be a free agent, must be possessed of all the powers of an independent spiritual force; or, if not so, must descend to be the mere blind follower and servant of material powers. Nevertheless, we may rest assured that the materials forming the bodies of animals, indeed of all organized beings, *are* possessed of a force above and beyond any that reside in the brute matter from which their substance is renewed; and that, after long centuries of patient observation, and after the most recent searching experiment, this force can only be attributed to the impress of the Almighty Creator upon all organized germs when He called them into existence, and bid them multiply their species and replenish the earth. Let the religious mind cease to dread the researches of science into the arcana of life, and be satisfied with this:—In whatever way matter first became possessed of vital force, so as to give rise to the varied phenomena of life and mind, all our observations and experiments have never yet shown it to us in the *act of assuming this force of its own will or power;* and, as germ only proceeds from germ, whether vegetable or animal, and as organized structures are continually increasing, so there must have been a time when every fresh furnishing of the earth's surface was set on foot by the fiat of the same Omnipotent Eternal calling into existence the primordial germs of all its organized beings.

SECT. II. DIGESTION.

Having already sketched in outline the major function of Nutrition—growth and repair—the lesser one which ministers to it will occupy a less portion of our space than it would otherwise have demanded. Digestion is a process which, beginning

with the mouth, by which the food is apprehended, ends in the stomach and intestines, where, now reduced to a pulpy mass, it is absorbed into the current of the blood. In man, the organs of digestion are sufficiently well known. They comprise the means of masticating and triturating the food into small particles; of mixing it with the saliva secreted by the glands of the mouth; of deglutition, or swallowing, by which it is received into a central sac or stomach, where it remains for a time undergoing the combined influence of physical, chemical, and vital forces. Here it meets with warmth to facilitate the swelling and separation of the particles of the food; fluid, in the shape of drink, to insinuate itself into the meshes of animal fibre and the globules of starchy food; gastric juice to act chemically upon it; and a peristaltic or churning motion of the stomach itself, to bring the whole mass into contact with the digestive juices; and lastly, the living membrane composing the gastric walls, with its peculiar cell-action, by which the liquid part of food is directly absorbed, and an impression made by its vital forces upon the remaining mass.

All this seems simple enough, now that exact experiment and the observation of the actual working of a human stomach, by fortunate accident laid bare to our inspection, has brought the process of digestion under our very eyes. Formerly, however, the most contradictory theories of the nature of digestion were held by the learned; and fierce were the battles which were fought over the body of the victim, to establish each one his own favourite theory. The celebrated saying attributed to John Hunter sets out the more salient points of those different notions. "Gentlemen," said he, "some people call the stomach a mill, and believe that it grinds the food; others will have it that it is a fermenting-vat; others a

stewpan; but to my thinking it is neither a stew-pan, nor a fermenting-vat, nor a mill; but a stomach, Gentlemen, a stomach." And a stomach it has ever since remained.

Cause of Digestion.—The immediate or proximate cause of digestion is the presence of food in the stomach, whereby its nerves are excited and a flow of blood attracted to it. From this, gastric juice is secreted. The secretion of gastric juice is further accelerated by the stimulus of the senses, as the smell; and by emotions of the mind, such as the anticipation of a good dinner or of something particularly gratifying to the palate; also by a kind of gustatory sense, possessed by some people in a higher degree than by others. That portion of the digestive function which goes on in the stomach consists principally in the solution of the food in the gastric juice, which solution is chiefly, although not entirely, of a chemical nature.* This process (which occupies a longer or shorter time according to the nature of the substances to be digested, and to the innate powers of the stomach itself) being completed, the food is passed on to the next division of the alimentary canal—the small intestine—in a form which enables the absorbent vessels and cells, which are there placed very thickly, to suck in such portion of the material presented to them as their vital elective affinities will attract. What is not there made use of is passed on to the large intestine, where, after being made to give up any remaining

* The chemical theory of the action of the gastric juice, although true in the main, has undergone some modifications of late from the researches of Continental physiologists. That the vital powers of the stomach and its secretion are able to form fresh combinations out of those which they have just destroyed, and which can scarcely, if at all, be affected by them when out of the body, is pretty well established, and removes their operation beyond the boundary of mere physical laws.

portion of nutritive matter, the residue is ejected from the system.

The function here described must necessarily vary much according to the nature of the substances submitted to its action; and the choice of food must have originally been, and indeed, as regards any new alimentary substance, still is, entirely tentative and experimental; although it is guided, no doubt, by a certain instinct resembling in kind, though much less perfect in degree, than that which unerringly guides the lower animals in the selection of their food. The almost omnivorous character of human digestion has been established only in civilized nations, which have become possessed of a great variety of materials for food. Man is still very far from being strictly omnivorous. There are many inferior species of the animal kingdom which live upon substances which, to us, would be either innutritive or else prove positively poisonous. Whilst one insect will live upon cayenne pepper, and another fatten upon strychnine, the extent of our range of food must be admitted to be not universal. In truth, it is the fact of man having been formed for occasional subsistence upon an exclusive diet of animal or vegetable food, or upon a mixture of both, which has gained him the appellation of omnivorous.

We shall never err in taking Nature for our guide. The examination of the structure of the mouth, teeth, stomach, and intestines of man show that they have affinities both with the carnivorous and the herbivorous animals, with certain proclivities towards the latter. With teeth of no very great power for cutting and tearing in the front of the jaw, which is its weakest part, but with large and strong molars or grinders placed in the most advantageous position for grinding and mixing with saliva the farinaceous portion of his food, he shows himself to be considerably

more of a vegetable than of a flesh eater, although the apparatus for both is perfect. Coming to the stomach and intestines, we find a great resemblance to the parallel organs in certain grain-devouring animals—the rodents or gnawers. So that we are entitled to conclude that the use of a larger quantity of vegetable than of animal food is normal to man; whilst we know that in some parts of the world he lives exclusively on one only of these substances.*

It is impossible, therefore, from the examination of the teeth, to predicate what kind of food will be most suitable for the residents in any particular climate, or season of the year. The natural productions of a country, its mean temperature, and the habits and employments of the people, will best decide this point. It is certain, however, that animal food is more heating and exciting, even in this climate, and still more so in hotter regions, than a vegetable diet; and that it requires a different action of the digestive organs.

I will now describe in brief the operation of the various portions of the digestive canal upon food of different kinds.

Mastication.—Beginning with the mouth, mastication should be well performed. It will vary in its kind in the case of animal and vegetable food. The

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* The similarity of dentition in all races of mankind, although many of them use food derived from one only of the great kingdoms of Nature, is a sufficient evidence that every race is endowed with the power of varying the nature of its diet according to the circumstances of climate, &c., in which it may be placed. That every race is capable of living in every part of the habitable globe we know, although from long ages of seclusion in one or other extreme of temperatnre, the Negro and the Laplander may ill bear sudden or violent changes in this respect. Can there be a stronger argument than is afforded by this peculiarity of dentition for the specific unity of the human race; and also for the belief that it is the intention of the Creator that they should all ultimately freely blend and mingle with each other in every clime?

first is too often swallowed in large pieces, which have only been pressed between the teeth, and not separated or comminuted into small particles. It is true that the mixture of saliva with flesh is *not* so important as in the case of bread, potatoes, and other starchy foods; but unless the meat be well divided by the teeth, the action of the gastric juice is less effective, and requires a longer time to penetrate the interior of the mass. But bread, and all articles made of flour, should be retained in the mouth a sufficient time to allow of complete trituration and mixture with the saliva; for by this fluid a great part of their digestion is effected. Hence, new bread, from its doughiness, is apt to get compressed into a hard ball in the mouth, which the saliva cannot penetrate, and so often lies "like a lump of lead" in the stomach, causing there severe pain or uneasiness. When much farinaceous food—as potatoes, rice, peas, &c. —is taken at a meal, it is well to swallow small quantities of fluid—water, beer, or wine-and-water —from time to time, to excite an increased flow of this indispensable secretion. The propriety of taking fluid during a meal is now pretty well settled in the affirmative. It appears, from observation of artificial digestion out of the stomach, that *moderate* dilution of the mass brings the gastric juice into more complete contact with every portion of the food, and so assists in the equable and regular digestion of the whole. Too great dilution, on the other hand, only weakens the acidity of the gastric juice, and so diminishes its solvent action.

Action of the Stomach.—The mixed bulk of food and saliva having reached the stomach, it is there that digestion proper begins. Even the saliva, which plays so large a part in the conversion of starchy substances, has no time to operate until it reaches the stomach. The gastric juice, which is

poured out by the glands of the stomach as soon as food reaches it, or sooner perhaps if the appetite have been excited by the sight or smell of savoury viands, or by allowing the mind to dwell upon the thought of eating, at once attacks the mass of food; muscular fibre being the favourite object of its attentions, which it divides and separates into its minute and ultimate fibrils. Assisted by a temperature of 100° or 101° this solution goes on very quickly, and in half-an-hour great changes have been made in the exterior of the masses of food. As the external portion softens and falls off, the gastric juice is enabled to reach the interior; and so, after a period varying from one to four or five hours, the whole is reduced to a soft pulpy mass. This process is assisted by what is called the peristaltic action of the stomach. By this motion, the food takes a circuit of the walls of the stomach several times before it is parted with. It is a kind of churning motion, of which, by the way, we are entirely unconscious, which passes the food along the walls of the larger curvature of the stomach towards its intestinal extremity; but it is not yet allowed to pass through there, being carried back along the upper or smaller curvature, and so round and round until it is in a fit state to leave the stomach and pass into the intestine. Each of these revolutions is completed in from one to two or three minutes."*

Whilst this process is going on, the pylorus, or intestinal aperture, or door, of the stomach, opens at frequent intervals to allow that portion which has been reduced to a pulpy semi-fluid mass to be pressed through it by the contraction of the fibres of the adjoining parts of the stomach, the more

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* Dr. Beaumont's Experiments, cited by Dr. Brinton, "Food and its Digestion," p. 102.

solid and undigested portion of the food being kept back.

The food is detained in the stomach in the state of health, and, if proper rest be taken, for a sufficient time for all that portion of it which is digestible at all, to be acted upon. This time varies according to the powers and temperament of the individual, to the quality of gastric fluid poured out,* and especially to the kind of aliment submitted to digestion. Elaborate tables have long been before the physiological public, in which the time necessary for the chymification of the food, so far as the experience of a single individual goes, has been ascertained with tolerable accuracy. Alexis St. Martin, a Canadian, who, from the effects of a gunshot wound, retained afterwards a kind of valvular opening into the stomach from without, fell under the observation of a most judicious observer and careful experimenter, and the results obtained have furnished most of the data of this kind which can be relied upon.

The time in which stomachic digestion is completed depends upon—besides the variation in the nature of the food—the excellence and quantity of the gastric juice, the proper position of the body, and the absence of disturbing influences upon the stomach. Hence it is evident how injurious it must be for the full stomach to be disturbed, violently shaken, or deranged by the operation upon it of emotions of the mind of an exciting character. Quick walking or riding, and

* From some recent researches of Grunewaldt, it appears that the quantity of gastric fluid poured forth into the stomach and intestines enormously exceeds the quantity formerly supposed, and reaches, in the adult healthy man, to not less than thirty pounds avoirdupois in the twenty-four hours! Although further experiments may somewhat modify this astounding result—a quantity equal to one-fourth of the weight of the whole body—the immense importance of careful attention to the condition of this organ cannot be exaggerated.

violent motion of any kind, ought especially to be avoided. At least one hour ought to be allowed after a full meal, during which none but passive exercise should be taken. During this period the warmth of the body should be especially attended to, and all ligatures and tight compresses removed. Many persons, who suffer from uneasiness and distension after food, require, and should not neglect, to loosen the dress about the waist, so as to give perfectly free play to the motions of the stomach.

Besides eating slowly, so as to allow of complete mixture of the food with the saliva as it passes through the mouth, it is of prime importance not to continue the process of eating for too long a space of time. By doing so, the earlier portions of the meal, which are undergoing the rotatory motions of the stomach, and engaging all its care, are interfered with by fresh portions of food being added to the mass. It has, indeed, been asserted by a good authority, Mr. Mayo, that eating again before the last meal is digested is of no hurtful consequence. This assertion, however, is not supported by the experience of the mass of individuals, and it is directly contradicted by the experiments upon St. Martin, in whom, whenever fresh food was added *during* digestion, it never failed to cause disturbance and retardation of the process. What is here meant, however, is, that there is danger in continuing to eat ever so little, as dessert, for a long time after the commencement of dinner, not that frequent meals are not advisable in some cases. The flavour of food, and the pleasure it gives to the palate, has its uses in inducing us to retain it in the mouth a sufficient time for it to get intimately blended with the saliva; but, like all other pleasures, it must not be abused by sitting too long at table.

Again, by eating slowly, a much larger quantity of food can be received by the stomach, without

uneasiness, than when it is bolted quickly, and in large masses; but we must not allow even this good habit to make us oblivious of the time when the stomach sends up word, as it invariably does, if we will but listen to its *still small voice*, that it wants no more.

Intestinal Digestion.—Let us now follow the semi-digested fluid mass of food out of the stomach into the lower part of the digestive canal, the small intestines, and see what takes place there. The pulpy homogeneous mass, which is now called *chyme*, is not yet converted into the living fluid which it becomes when it enters the blood. There are here two coadjutors to complete digestion—viz., the pancreas, or sweetbread, and the liver. The ducts from these glands pour their peculiar fluids into the intestine, where they are mixed with the chyme, by which fresh changes are effected. The food, before acid, is now rendered alkaline; the oily and fatty portions are partially saponified by the pancreatic juice, and the action of the bile, which still, to some extent, remains in obscurity, seems to separate the organic from the inorganic portions, and so completes the conversion of crude *chyme* into perfect *chyle*. In this last process there are chemical changes involved which are of too recondite a nature for the comprehension of the general reader. One thing, however, he will understand. Up to this point the food, although disintegrated and dissolved, is still in chemical solution: it is not yet organized into living molecules or cells. Now, however, begins that beautiful but, unfortunately, insufficiently-known process, by which globules or cells are formed, the albumen forming thin filmy walls to the little oily globules preparatory to their entry into the current of the circulation. In the *villi* of the small intestine are seated those absorbent ducts, lined with their peculiar cells, by

which this entry is effected; and after passing along the thoracic duct, the newly-made food is ready to be mingled with the blood, to go to nourish the tissues throughout every part of the body. It is the refuse mass—consisting chiefly of the indigestible parts of vegetables, stringy bits of meat, husks, and seeds, which defy the powers of the stomach—that forms the residuary matter passed into the lower bowel; whence, absorption having once more, like a careful gleaner, gone over the mass, to see if any remains of nutriment have been overlooked, it is finally expelled from the system.

Rules for Good Digestion.—It now remains to record a few accessories to good digestion, which must not be overlooked by those who desire to attain to, or retain, a high state of health. The perfection of the digestive act will depend, as has been already stated, upon the goodness and quantity of the gastric juice; and as this fluid is secreted by the stomach directly from the blood, unless the latter be in normal quantity and quality, a healthy secretion and perfect digestion cannot be expected. The sedentary clerk, sitting all day at his desk, without taking exercise to circulate his blood, and thereby to purify it, wonders why he cannot digest his evening meal, even though he may have duly taken his walk in the air to get an appetite. His impure and lethargic blood will not secrete good gastric juice. Ill-elaborated food consequently enters his system; or, at best, there is not a sufficient quantity, perfectly digested, to support the wear-and-tear of his daily labour. He is starved in the midst of plenty; and whilst believing, from his uneasy feelings, that he takes too much, and thinks the proper remedy would be a stricter diet, his vital powers are actually exhausted in the vain attempt to digest the requisite quantity of food. The craving for support which this unnatural state of the system

induces, demands supplies which the stomach is unable to afford, and the unhappy sufferer dies at length of what is virtual starvation.

Shorter Hours of Sedentary Labour.—There will be no diminution of these dyspeptic miseries until the hours of sedentary labour are not only shortened (as they already are in many establishments), but *divided in the midst, by a cessation from work, even by those who do not dine in the middle of the day, for an hour, or an hour and a half, every day;* during which time light out-of-door exercise should be taken. Eight hours' continuous labour of this kind is far more exhausting than two portions of four hours each. Indeed, I believe that nine, or even ten hours' desk-work would be better borne than seven or eight are now, were the principle of intermission properly carried out.*

Whenever, from any cause, the body has been over-fatigued, care must be taken not to overload the stomach with much food. No organ sympathizes with the fatigue or exhaustion of the general system so readily as the stomach. Travellers, especially by railway, should eat sparingly; the excitement and heat produced, chiefly by the long confinement in impure air, reduces the quantity of digestive fluid secreted, which should be met by a corresponding reduction in the amount of food, especially of flesh-meat. Light meals, of a farinaceous character, soups (though not the *réchauffés* of the

* It is here that the principals of merchants' and other business offices, solicitors, and others, who remain at the desk from ten to four or five o'clock, are often worse off than their subordinates, who, although the time be all too short, do get a respite at their noonday dinner. The hasty luncheon — often a sandwich, or biscuit, and glass of sherry—without really relaxing the mind for an instant, is only applying the whip to the tired horse. What is wanted is that rest which a man whose business is in his own house can steal once or twice in the day.

railway refreshment-rooms), and especially tea, are the most wholesome when travelling.

SECT. III. FOOD.—MEAT AND DRINK.

The definition of food in the abstract has already been given. In detail, we may divide it according as it is derived from the animal or vegetable kingdom, according as it is presented to the stomach in a solid or liquid state, or with reference to any other physical character. For any useful purpose, however, it must be looked upon with a view solely to three points—viz., the power which it possesses of nourishing the body—*nutritive quality;* its capability of being digested—*digestibility;* and its agreeability with the taste and feelings of the individual—*savour.*

Animal and Vegetable Food.—Adverting for a moment to the division of food into animal and vegetable, modern physiology has shown that, in all essential particulars, the chief members of each of these classes possess the same principles as the other; so that, however much men may differ in their estimate of the propriety of using only one or other of these classes of food on social and economical principles, to the due nutrition of the body the question is almost an indifferent one.

Vegetarianism some years ago had numerous devotees, who based their condemnation of animal food upon the assertion that it was never intended for man to slay his fellow-animals for his own support, and that their flesh was not so suited to his digestive organs as vegetable food. The physiological basis upon which they grounded their assumption was an unsound one; being not only in opposition to the instincts of the whole human race, in all ages, but also disproved by the necessity under which whole nations, with similar digestive organs to our own, lie of living entirely on animal substances. It would be

fighting a shadow to enter into the lists with a sect which—however amiable, and even talented, may have been some of its members (the poet Shelley having been one)—is now reduced to insignificance.

Greater Cost of Animal than Vegetable Diet.—The consumption of animal food *in excess* is, however, well worthy of the attention both of the physiologist and the political economist in another point of view. It is the most expensive kind of diet which a population can adopt. Looking at the domestic animals as machines for converting vegetable substances into animal tissue, the composition and structure of which more nearly resemble those of our own bodies than any other kind of food, the process is, at best, a wasteful one. Animals live, and move, and expend the forces which they derive from their food in a variety of ways; and thus a large quantity of vegetable nutriment is used to produce a small quantity of animal flesh. Were, indeed, all the forces which they derive from their food husbanded, and laid up in the flesh of animals for our use, then we should be using the latter as a merely concentrated form of the former without its suffering loss in the transit. But the fact is, that a large portion of what is eaten by animals goes, as in our own case, to maintain the heat of their bodies, which is continually being dissipated into the air and lost. Hence, a bushel of corn, which is converted into so many pounds of animal fibre, would produce, if eaten directly as food by man, a far larger amount of human flesh than will the meat which the ox or the sheep have been able to make out of it. It is on this account that living is so much cheaper, at least for the humbler classes, in other countries than it is in England, which is the most flesh-consuming country in the temperate region of the globe.

Great Consumption of Animal Food in England.—

There are two reasons, perhaps, besides the fact that the climate of Britain favours the rearing of flocks and herds, which tend to foster the custom of eating large quantities of animal food. The first is, that, as a rule, the English enjoy a good digestion, arising from their addiction to active out-of-door exercise. The second is, that we are accustomed to eat rapidly, and to be sparing of time at our meals. Farinaceous substances require a longer mastication, and cannot be bolted like meat, as Dr. Chambers expresses it, between two entries in the merchant's ledger. Animal food, being digested chiefly by means of the gastric juice, will stand this kind of treatment better than any other.

Preference to be given to Animal and Vegetable Food respectively.—The preference to be given to one kind of food over the other will depend upon various circumstances which are chiefly of an individual character. Whilst our digestive organs partake conjointly of the structure of carnivorous and of herbivorous animals, it is probable that the stomach of one person may favour animal, that of another, vegetable food. And this is only what we may expect from the great latitude which Nature seems to have allowed us in regard to food.

The very young of all animals require for a time a food—milk—which, although entirely derived from an animal source, very nearly approaches in composition those vegetable substances which are contained in grain and seeds, for the nutrition of the young plant. There is in each an admixture of albuminous, oily, and saccharine principles. As the human infant grows older, it becomes capable of digesting small quantities of animal food, which should be largely mixed with the vegetable principles,—starch, sugar, and oil (butter). From a year and a half to two years old, is a very good time to begin to add animal

flesh to the diet of children. At the age of fourteen, the youth will consume as much flesh as an adult person, and, in cases of rapid growth, even more.

Many persons seem to have so hot and irritable a digestive system, that none but farinaceous foods agree with them; others again, of a phlegmatic and cold nature, will eat enormous quantities of flesh without injury. In all such cases, peculiarities of temperament play a prominent part, as do also habits, especially if they have been inherited. Persons whose ancestors were accustomed to good living do not bear a lowering diet so well as those whose parents lived in more humble circumstances.

Again, the choice of either animal or of vegetable food, or the apportioning of each to the wants of the individual, will much depend upon the kind of labour, and upon the demands made upon the vital powers, as well as upon the opportunities afforded by the habits of life for few or frequent meals. Animal food, as being more concentrated than vegetable, is the best adapted to sustain the powers of life under great exertion—as in training, feats of pedestrianism, mountaineering, and other arduous out-of-door pursuits which rapidly waste the tissues of the body: also, where it is desirable or necessary to go a long time between meals. It is obvious also, that, when the body has been much wasted by want or disease, so soon as the digestive organs have regained sufficient power, animal food will restore the forces of the system more rapidly than any other, and with less expenditure of the assimilative forces. Oily substances, particularly the fat and oil derived from quadrupeds and fish,—the type and perfection of which is cod-liver oil—are particularly serviceable in restoring the waste caused by over-exertion, disease, or want. Not only are these oily (I do not call them *oleaginous*) substances readily assimilable to the

tissues of the body, but they appear to assist the conversion of other substances, as starch and gluten, into animal fibre. To restore the powers wasted by disease, *small* quantities of easily digested animal food, frequently repeated, are the best resource; and if the stomach is unable to cope with it in a solid form, beef-tea and other mild broths are the best substitute.

If now we turn to the products of the vegetable world, we shall be struck with the vast number of substances which enter, in some part or other of the world, into the food of man. It is here that Nature has given to him the widest range of choice; and, all things considered, catered for his tastes with the greatest assiduity. In this kingdom we find solid aliments, in the various grains, equal almost to the flesh of animals in nutritive power; more sapid but less nutritive substances, laid up in the roots of various vegetables; highly-flavoured and stimulating matters in the leaves, stems, and juices of trees and vegetables; and lastly, fruits of most delicious flavour to cool his parched system, and to add to the pleasures of the table without materially increasing the demand upon his digestive powers. From all this—extended, too, as these various products are over the greater part of the earth's surface, and easily procurable by the inhabitants of any civilized country in which they are not indigenous—we may plainly deduce the conclusion that Nature has intended that we should make our chief dependence upon the virgin productions of her soil; and that we should look upon our flocks and herds as reservoirs only of food, to save time and labour in an artificial, and to some extent unnatural, condition of existence.

When it is said that vegetable food is a *cooling* diet, little more can be meant than this—viz., that being digestible by the juices of the mouth and intestines to a considerable extent, it makes less demand upon

the supply of gastric juice, which, when excessive, taxes the powers of the system very largely. From its more inert nature, also, its presence in the stomach is less felt in cases of irritation of that organ. Data, however, are still wanting to estimate correctly the comparative demand made upon the digestive powers, as a whole, by animal and vegetable substances respectively. It is true that old people, and those whose vital powers have been lowered by disease, bear vegetable food or milk best—a fact owing, probably, to the diminution in the quantity of secretion in the old and infirm, and to the loss of sensibility of the stomach to the stimulus of food.

People who use a large quantity of vegetable food in their diet, particularly professed vegetarians, frequently grow fat—a proof of the fat-making powers of starch, sugar, gluten, and other of the proximate elements. It is to be feared, however, that this is a hurtful process. The conversion of muscular fibre into fat, or at least the deposit of oily globules amongst its fibrils, especially in early life, is often of serious and even fatal consequence, by reducing the power of that great muscle, the heart, and, under any great exertion, causing the rupture of its tissue.*

THE ESSENTIAL PRINCIPLES OF FOOD.

A. *Their Nutritive Qualities.*—From the days of Hippocrates it has been the opinion of some that,

* In addition to the foregoing remarks, the following may be considered as a summary of our knowledge on this head, so far as it at present enables us to decide upon the merits of either description of food in particular cases. Animal flesh, presenting as it does the closest resemblance to the tissues of our bodies in the composition and arrangement of its secondary elements, is more easily and, bulk for bulk, more quickly converted into chyle, so as to enter the system with greater rapidity than vegetable substances. It is, therefore, more suited to rapid eaters, to persons whose circulation is vigorous, and who take much exercise in the open air; also in certain states of the system where there is little saliva

although there are numerous kinds of food, there is but one aliment. This saying has been bandied about until its meaning, never perhaps very precise, has become obscure. If the Father of Medicine intended by it to convey his opinion that all nutritive substances are presented, after digestion, to the

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secreted, or where, from disease of the liver or pancreas, vegetable food cannot be well digested. To those who habitually exhaust the muscular or nervous system by great exertion of the body or mind, animal food is most quickly restorative. In some cases its digestibility should be secured by minute division, either by comminution into small particles, or by pounding. The flesh of young animals, in which gelatine is intimately mixed with the fibrin, and of well-fatted ones, in whose flesh oil-globules are largely intermixed with the muscular fibre, is more digestible, though somewhat less nutritive, than that of older and tougher animals. In the latter case, the meat should be kept just up to the point when it becomes tender—that is, when the fibres are easily separable from each other, but not a day longer, as all approach to putridity is most objectionable, and likely seriously to disturb the digestive process, if not actually to poison the blood. Eggs, milk, and animal fats are all easily digestible, and form together a perfect food.

As regards vegetable food, the proportion which it should bear to the whole diet must vary according to the age, temperament, and mode of life. Children that are weaned should be kept chiefly on the most digestible of vegetable food, with a fair allowance of good cow's milk. The fashion of ordering for very young children in delicate health mutton chops (frequently accompanied with alcoholic stimulants) cannot be too strongly reprobated. It is opposed to all sound physiological teaching, and, in its rash interference with the order of Nature, is only equalled by that poisoning with alcohol by which many dying patients are sent intoxicated out of the world. The stomachs of young children are unable to digest a large ration of flesh-meat, and sickness and disorder are invariably the result of excess in this particular. In the same category with children are to be placed many delicate women, and old people. The secretion of gastric juice is, in them, deficient in quantity, perhaps also in acidity ; and whilst a meal of animal food oppresses them, they will eat largely and repeatedly of bread, rice, or other mild vegetable substances. Girls require less animal food than boys, as their bodily waste is less. Delicate and refined girls frequently abhor flesh-meat, and should, in that case, be fed upon eggs, milk, puddings with a little suet in them, with a proper allowance of bread and other vegetable matter. There is nothing in the mere fact of growing which can alter the propriety of these directions, as quantity is then of even more importance than quality.

absorbent vessels in the same form and chemical condition, modern science will contradict him. If, however, he wished it to be understood that the ultimate elements of the body are always the same, under whatever kind of food, and that that only is perfect food, in the strict sense of the word, out of which they can all be formed, his proposition, in the absence of any demonstration to the contrary, may be provisionally conceded.

It has been already said, that the higher-class products which the vegetable kingdom furnishes for our food, such as the cereals—wheat, barley, oats, rice, &c.—so much resemble, both in their ultimate composition and their proximate or secondary elements, those of animal flesh, that, for dietetic purposes, it is almost a matter of indifference which of the two is used. Moreover, some of the less nutritious vegetable matters, as the oils, are analogous in their composition to the same class of substances found in animal food. The reader will not, therefore, be surprised to find that, in ranging foods according to their characteristic constituents, animal and vegetable substances are here placed indifferently in the same categories.

Thus, the classification of Dr. Prout, which on account of its simplicity and physiological exactitude still holds its ground, places all kinds of food, animal and vegetable, in one or other of the following classes, viz. :—

Class 1.—*Albuminous* (or albuminoid) or nitrogenous substances.

Class 2.—*Oleaginous*, or oily } or carbonaceous.
Class 3.—*Starchy*, or saccharine }
Class 4.—*Aqueous*,—Drinks.

Albuminous or *Nitrogenous Food.*—Albumen, the great nitrogenous element of food, and the substances

allied to it, are furnished by the flesh of animals, eggs, milk, cheese, &c. An analogous substance, called vegetable albumen, exists in the farina or flour of wheat, oats, barley, maize, rice, and all cereals; also in leguminous seeds, as peas, beans, lentils, &c. The typical albumen is found in the white of egg, where it is as nearly as possible pure. The serum, or fluid part of the blood of all animals possesses a large quantity of it, and it is in that form that it is carried about from end to end of the system, to be deposited, as fresh tissue, to supply the place of that daily wasted by the functions of the body.*

The following is the more elaborate but less scientific classification of Foods, as given by the late Dr. Paris, in his excellent work on Diet :—

1. *Fibrinous Aliments.*—The muscle (including the blood) of animals, more particularly those which have arrived at maturity.

2. *Albuminous.*—Eggs, and other similar matters.

3. *Gelatinous.*—Flesh of young animals, veal, lamb, &c.

4. *Fatty* or *Oily.*—Animal fats, butter, oils, pork, bacon, &c.

5. *Caseous.*—Milk, cheese, &c.

6. *Farinaceous.*—Wheat, barley, and other cereals; arrowroot, sago, &c.

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* In elaborate works on Diet addressed to the physiological reader, it will be found that various names are given to these albuminoid substances, according to the tissue from which they are derived. Thus may be enumerated—1st. FIBRIN, or Syntonin, derived from the muscular fibre; 2nd. ALBUMEN proper, from the same source; 3rd. GELATINE, which is contained in the cellular tissue everywhere lying between the molecules of the other tissues, also from sinews and cartilages; 4th. CHONDRIN, from the larger ligaments, &c. These substances vary considerably in their respective digestibility and nutritional powers. But as, in the ordinary methods of cooking, these are inseparable, it is unnecessary here to go further into their details.

7. *Mucilaginous.*—Carrots, turnips, asparagus, &c.
8. *Sweet*, or *Saccharine.*—Sugar, figs, dates, &c.
9. *Acidulous.*—Oranges, apples, and other acidulous fruits.

The fault of this arrangement is that it bears no relation to the physiological or dietetic value of the substances grouped into each class. Thus albuminous aliments only include those derived from an animal source; farinaceous, as wheat, &c., which have the closest resemblance to them, being placed sixth on the list, and below the fatty or oily, which are of an entirely different order. The farinæ of wheat, barley, oats, maize, rye, rice, peas, beans, potatoes, &c. possess, in various proportions, the same ultimate elements which form the flesh of animals. They are oxygen, hydrogen, nitrogen, carbon, sulphur, phosphorus, and lime—all of which enter into the normal tissues of the body. Not only is this so, but the secondary forms into which these chemical elements are grouped are nearly identical in each. It is from the first great class, the albuminous, that most of the tissues of the body are formed and repaired; we may therefore with propriety give the first place to it. The characteristic of this class is their possession of a large amount of nitrogen, and it is in reference to this kind of food chiefly, that our remarks as regards the use of animal and vegetable substances, in the preceding pages, have been made. In different countries of the globe, and even in those most nearly connected with each other in situation, and in the pursuits of industry, the utmost differences exist in the form in which the populations use these *protein* substances. Whilst the Englishman of every degree believes that he cannot, reasonably speaking, have too much animal food, and the poorer classes—who see little of it, except in the oleaginous form, as bacon—still

think that flesh-meat goes a great way further than bread, the Scotch shepherd or labourer gets only his weekly allowance of oatmeal, and a little milk; nevertheless, he does not yield to his southern compeer in bodily strength, or in endurance of cold.* The Irishman again, with his potatoes and buttermilk, provided he gets plenty of them, can do a hard day's work upon this poor and scanty fare. The only difference is that a greater tax is laid upon his digestive powers, by the great bulk which he is obliged to consume. Two pounds of good bread, with an allowance of water, will sustain life in high health and strength, whilst from eight to twelve pounds of potatoes will be required to do the same.†

Their Use.—The chief induction to be drawn from a study of these various proximate nutritive constituents of the articles of food is, that they descend in value pretty much in proportion as the nitrogen they contain is replaced by the carbonaceous element. Hence it is that to lay down a scale of diet without knowing what are the requirements of the individual who is to use it, or his peculiarities of age, sex, temperament, and employment, would be as puzzling as the rules for finding the genders of French nouns, in several of which the exceptions exceed the number of the examples.

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* Although the nutritive power of oatmeal is now well known to be far less than that of good wheaten flour, yet such is the force of national prejudice, that when oatmeal, from a failure in the crop, was exceedingly dear in Edinburgh, and the millers were accustomed to mix with it wheat-flour, there was a popular outcry that they had *adulterated* the good meal with a base substitute.

† Individuals are known to do very well on bread-and-water alone for months together; and the author has been told, by good authority, of a workman—a carpenter—whose diet for many years past has consisted of two pounds of bread daily with water: nothing else. He is in the habit of putting the bread into a large jug, which he fills with water, overnight. This sop supplies him with three meals on the succeeding day. His health is excellent.

A large allowance of the nitrogenous substances which are found in the flesh of animals, and in bread, rice, and other cereals, will be found to be required whenever that element of the body is materially reduced, or suffers daily great exhaustion. They are therefore necessary to the manual labourer; to those whose hours of work or duty are excessive; and to the brain-worker, who exhausts the vital force with equal or greater rapidity than any other by the large afflux of blood to the brain required to generate continuous thought. Whether the animal or vegetable form of albumen will best suit these cases will depend upon the circumstances already mentioned in the previous section; upon the number of meals in the day, the rapidity of digestion, &c. If the digestion be active, and plenty of time be allowed for taking the meals, a large supply of vegetable, with a smaller one of animal food, will be found the best. On the other hand, those who have to take their meals quickly, and at long intervals, feeding like the boa-constrictor, had better use more flesh. Always remember, that if a large quantity of flesh-forming food be taken into the body without that amount of exercise which will make room for new tissue by destroying the old being undergone, a redundancy of nutritive matter will accumulate in the system, and congestions, inflammatory diseases, hæmorrhages, and various disorders of the digestive organs, will be sure to result. Waste *must* be proportioned to the supply, or else the system will have nowhere to bestow her goods, and confusion and disorder will be the consequence.

Carbonaceous Food—Theory of Liebig on Animal Heat.—The next two classes into which food has been divided, the oily or fatty, and the starchy and saccharine substances, have been, of late years, classed together under the title of *Calorificant*, or *heat-making* food. To Baron Liebig we owe this

great generalization: for, with all its errors of commission and of omission, more practical results have followed the introduction of this theory in the way of apportioning dietaries to the actual wants of the system, than of any other. Besides the first duty of maintaining the building in its integrity, of repairing all breaches, and restoring lost parts, which albuminous food performs, the great function of animal heat requires an amount of labour and a constancy of operation which is only second, if second, to the other. That Liebig was right in laying down his principles so absolutely, I do not think; and his dicta have since been very considerably modified by physiologists; for albuminous diet is found to be capable of maintaining the heat of the body, although less efficiently than one consisting largely of substances which are compounded of hydrogen and carbon in certain proportions. Indeed, the great error of Liebig seems to have lain in maintaining too exclusively that the temperature of the body was sustained by a *direct* chemical action between the carbon and hydrogen of the food, and the oxygen inhaled by the respiration; and in not giving sufficient prominence to the fact that the destruction of the tissues of the body by means of oxygen, which is constantly going on, also eliminates heat in large quantity.

With this qualification of the great German chemist's theory of animal heat, it is unquestionable that much of the food we consume goes simply to maintain the proper temperature of the body: and the object will therefore be to find a material which shall perform this function with the least expenditure of strength. It is quite clear, from the instances of starving animals, that the animal heat *may* be maintained, although not at its normal pitch, by the waste of the materials of the body itself. So also will albuminous food alone suffice for a time to the

same object; but then a much larger quantity must be taken than would suffice were the oily or starchy elements properly blended with it.

The proper calorificators, however, are the compounds of hydrogen and carbon found in animal fat and oils derived from either kingdom, and starch, gum, sugar, mucilage, &c., which are obtained only from vegetable substances. The Greenlander, who consumes his twenty pounds of blubber a day, requires so large a quantity to develope a sufficiency of animal heat to enable him to withstand the rigour of his climate. The native of India lives upon a small modicum of rice and ghee, from which he extracts barely a sufficiency of tissue-forming food, leaving little to go to produce animal heat.

Their Use.—But how can we apportion this second description of food—the heat-producing—to the wants of the system? How much exposure to cold are you subjected to? How much manual labour do you undergo, thereby converting heat into muscular force by the destruction of muscular tissue? Are you actively employed in the open air, discharging carbonic acid gas freely, and inhaling oxygen as freely? Then a good deal of heat is being carried off from your body, and a proportionate supply of carbonaceous food is required. On the other hand, if you are only passively employed, in a wareroom, shop, or counting-house, in a room where the temperature is well preserved, but little waste of the heat-forming structures will take place, and only a moderate allowance of carbon in the food will be required. In this case, eat sparingly of butter, oil, or other fatty substances; and let a moderate amount of flesh and bread constitute the general diet. Common experience fortifies these rules, oily and rich food being ill digested by the sedentary, whilst albuminous substances agree very well with them.

The action of sugar, and its homologue, starch, is much the same as that of the oils. They are all desirable in cold weather and under much exposure; for children, and old people, both of whom require a large quantity of heat-making material.

Again, the proportion in which these two kinds of food should be used will depend in some measure upon the facility of mastication. Unless the starchy elements of food—bread, rice, arrowroot, &c.—can be well masticated and mixed with a due supply of saliva, they are always very imperfectly digested, and then do not afford sufficient nourishment. Old people, whose teeth have decayed, should feed principally upon animal broths, in which barley or rice has been well digested; or, which is better, boiled for a long time alone before being added to the other ingredients. By this means only will the thick capsule which envelopes the starch-cells be effectually ruptured, so as to allow of the digestive juices attacking their contents.

If the principles which should regulate the quantity of each kind of food—the building, and the warming—are now understood, it will not be difficult for any individual, according to the demands which climate, temperature, manual labour, or sedentary employment make upon the system, to regulate the general features of his daily fare, provided always that he has the means of doing so. As the oracular Mrs. Glasse says, *first* catch the hare, and then dress it so-and-so. The poor, and those who are ignorant of the laws of food, or who prefer to spend in drink the money which should go to nourish the bodies of themselves and of their families, are generally driven to purchase the *apparently* cheapest kind of food, of which potatoes form a large portion. But the cheapest kind of food is that which will give the largest amount of real nourishment for any given

outlay, and this is always either animal food, good wheaten flour with a portion of the husk left in it, oatmeal or peas-meal, with an allowance of butter or other animal fat. When sufficient quantity cannot be procured, it will become a question whether it is not better to retard the natural rate of waste of the body by the use of coffee, tea, or even tobacco, than to depend upon a diet of an innutritious character, which deceives by its bulk, and often lays the foundation of diseases of an obstinate and incurable description.

B. *Digestibility of Different Kinds of Food.*—We have now to look at the list of foods with reference to their digestibility and savour. Until lately, it might have been said that the degree in which the common articles of diet are digestible, as regards ease and rapidity, is an almost unknown quantity. Indeed, we may still say, that whilst the nutritive powers of different substances, both of the animal and the vegetable kingdoms, have been almost demonstrated by the advance of animal chemistry, so as to stand like A B C in an algebraical formula, from peculiarities of habit and temperament, their digestibility will rank amongst the unknown quantities of X Y Z. So great, indeed, is the variation in this respect *mediated* by peculiarities of age, habit, temperament, race, and climate, that nothing more than an approximative estimate can be gained. "What is one man's meat is another's poison," is a really true adage, exemplified in the case of a person who can with impunity eat a cucumber a foot long, whilst he is poisoned by a shrimp, or a morsel of herring.

The nearest approaches to accuracy which have hitherto been obtained in regard to the time occupied in the digestion of various aliments, have been the result of observations upon the persons

of those who have fortunately possessed a window in their stomachs, through which the operations of the interior could be inspected. When Momus of old blamed Nature for the incompleteness of her works, insomuch as she neglected to put a window in men's breasts that the thoughts of their hearts might be *seen* (?), he little imagined that the time would come when the *thoughts of the stomach* would be laid bare, with results infinitely less perplexing than if men had obtained the desired insight into each other's minds—an insight, I fancy, which might have been attended with results as confusing as when, at a game at whist, one accidentally sees the hands of the other players.

Two instances of valvular openings into the stomach have been made available of late years for this interesting observation. By far the most valuable as to results was the case of the Canadian, St. Martin, already mentioned. This man, being in good health, was subjected to a long series of experiments by an American physician, Dr. Beaumont. A great number of observations upon all kinds and mixtures of food were made, the more important of which are here tabulated:—

TABLE *showing the Mean Time of Digestion of the more usual Articles of Diet; compiled from* DR. BEAUMONT'S EXPERIMENTS UPON ST. MARTIN, *arranged in order of the Rapidity of their Digestion.*

1. FARINACEOUS SUBSTANCES.

Article.	*Mode of Cooking.*	*Time of Digestion. Hours and Min.*
Rice	Boiled	1.0
Apples (sweet)	Raw	1.3
Sago	Boiled	1.45
Tapioca	Boiled	2.0

FARINACEOUS SUBSTANCES—*continued.* *Article.*	*Mode of Cooking.*	*Time of Digestion. Hours and Min.*
Apples (sour)		2.30
Beans	Boiled	2.30
Potatoes	Roasted or baked	2.30
Cabbage	Raw	2.30
Apples	Sour and raw	2.50
Carrot	Boiled	3.15
Bread (Indian corn)	Baked	3.15
Bread (Wheat)	Baked	3.30
Turnips	Boiled	3.30
Potatoes	Boiled	3.30
Cabbage	Boiled	4.30

EGGS, BUTTER, CHEESE, &c.

Eggs (fresh)	Raw	2. 0
"	Roasted	2.15
"	Soft-boiled	3. 0
"	Hard-boiled	3.30
"	Fried	3.30
Custard		2.45
Butter	Melted	3.30
Cheese (old strong)	Raw	3.30

FISH.

Trout	Boiled or fried	1.30
Cod	Cured and boiled	2. 0
Oysters	Fresh and raw	2.55
"	Roasted	3.15
"	Fresh stewed	3.15
Flounders and other flat Fish	Fried	3.30
Salmon	Salted and boiled	4. 0

SOUPS.

Barley Broth		1.30
Hash (Meat and Vegetables)		2.30
Soup (Chicken)		3. 0

Soups—*continued.* *Article.*	*Mode of Cooking.*	*Time of Digestion. Hours and Min.*
Soup (Mutton)		3.30
„ (Oyster)		3.30
„ (Beef, Marrow Bones)		4.15
FLESH-MEAT.		
Tripe	Boiled	1. 0
Venison	Broiled	1.35
Liver	Broiled	2. 0
Turkey	Boiled	2.25
„	Roasted	2.30
Jelly	Boiled	2.30
Goose	Roasted	2.30
Pig (Sucking)	Roasted	2.30
Lamb	Broiled	2.30
Chicken (full-grown)	Fricaseed	2.45
Beef	Boiled	2.45
„ (lean)	Roasted, raw	3. 0
„ (Steak)	Broiled	3. 0
Mutton	Broiled or boiled	3. 0
„	Fresh, roasted	3.15
Pork (salted)	Broiled	3.15
Pork (Steak)	Broiled	3.15
Beef (lean)	Roasted	3.30
„ (with mustard and vegetables,	Boiled	3.30
„	Fried	4. 0
„ (Hard salt)	Boiled	4.15
Veal	Broiled	4. 0
„	Fried	4.30
Fowls, Ducks	Broiled, roasted	4. 0
Heart	Fried	5. 4
Pork (salted)	Broiled	4.15
„ „	Boiled	4.30
Ducks, Wild	Roasted	4.30
Suet (Mutton)	Boiled	4.30
Pork	Roasted	5.15
Suet (Beef)	Boiled	5.30

It will be seen from an inspection of this table, that there is no regular order in the degree of digestibility of the different substances of either animal or vegetable food. Some things the least expected are found in both classes to be remarkably easy of digestion, which were formerly supposed to be the reverse; and others which the stomach can only attack with the utmost difficulty once had the repute of being of easy digestibility. Raw apples, for example, which even yet are generally supposed to be hard of digestion, stand at the very top of the list. Again, venison, with other game (and oysters), now of acknowledged easy digestibility, would never before have been placed at so great an advantage over other meats of the same kind. Also, the long time taken by soups to be digested was not dreamed of when they made a large portion of the dietaries of our fathers, particularly of the young. Again, these researches have had the advantage of showing conclusively that the different modes of cooking food exercise a great influence in determining the time which is taken in its digestion. This fact raises the art of cookery very nearly to a science (Genius of Soyer, forgive me for the qualifying adverb!), and brings its dicta into intimate relationship with physiology.

There is one source of fallacy in these revelations which ought to be guarded against. It is the supposition that because a substance is easily digestible, it must therefore be a desirable object of diet. The rapidity with which an article of food is passed out of the stomach is very often merely a mark of the small amount of nutriment to be got out of it; substances which are highly nutritious, on the other hand, being detained by the stomach until it has put forth all its powers to extract their useful products. On this account we are in the habit of

calling certain foods *satisfying*, a term which generally means nothing more than that the stomach is engaged a long time upon them, and therefore the return of the feeling of hunger is longer deferred. Things may be slow of digestion, therefore, and cause some uneasiness in their assimilation, and yet be very nutritive; whilst others, although abounding in nutriment, may be irritating to the stomach, or entirely beyond its powers to digest unaided.

With this table before us, and always bearing in mind the caution as to individual peculiarities, the only other facts necessary to be dilated upon in this place are the circumstances as to the age and condition of different articles of food; the proper season for procuring them; and the processes by which their digestibility may be accelerated.

Circumstances conducing to Digestibility.—The first thing to be noted as conducing to the ready or difficult digestion of any alimentary substance, is the facility with which its fibres, in the case of meat—its cells and globules, in the case of oily or farinaceous articles—can be separated from each other. It is this divisibility which enables the salivary and gastric fluids to penetrate every particle, so as completely to elicit all its nutritive qualities, and, at the same time, facilitates and hastens the process. It is to this end that the mastication and grinding of the food are of such *prime* importance; and when, from age or decay of the teeth, this cannot be accomplished, the stomach must be allowed a longer time, and may with advantage be stimulated by an extra allowance of condiments to perform its task.

Now, anything which saves this trouble of complete mastication, or supplements it when it cannot be well performed, will be of great utility. Eating very slowly, by which every particle may become

intimately mixed with the saliva in the mouth, and dividing the food into small but *rough* pieces, are no small aids.

Another will be found in properly hanging meat until the fibres begin to soften and the connecting tissue to break down. The notion that the use of hanging meat is to induce in it an incipient decomposition, is a very mistaken as well as injurious one. Putrid meat, although capable enough of digestion (indeed, strong gastric juice seems to have the power of restoring the freshness to tainted meat), frequently disorders and arrests that process; moreover, there is danger of the putrid matter being absorbed directly into the blood, and giving rise to the most alarming symptoms.

Animal flesh may be more rapidly rendered tender by other means than by merely hanging. A high temperature for a single night, as in a cool oven (not exposed to hot and moist air), rubbing with sugar, or soaking in weak molasses, will also aid in this object; but long-continued lying, covered up in sugar, is a preferable mode of arriving at the same result, as it ensures perfect freedom from taint, with complete tenderness and great exaltation of the natural flavour.

Age and Season as regards the Selection of Food.— Almost all substances, animal or vegetable, have a season of *digestive maturity*, which is not always in accord with their physiological one. As a rule, the flesh of domestic animals is most savoury, and possessed of the greatest amount of actual nutriment, when they have arrived at full age. The thought of the eight-year-old wether mutton—now, like Johannisberg wine, only to be found at the tables of the princes and nobles of the earth—still waters the mouth of professed *gourmets*. Game is no exception to this rule, although being always

sufficiently high flavoured, the tenderness of youth is an additional advantage.*

Vegetable matters, to secure the highest degree of nutritive element with perfect flavour, should in almost every case be *ripe*. Corn, roots, fruits, are entirely different things when ripe to what they are at any previous stage. In the case of a few vegetables used in a juicy and very sapid state, as cabbage, lettuce, celery, &c., what is expected is rather savour than nutriment, and it is their high flavour, with the abundance of water in their structure, which enables the stomach to make anything of them.

C. *Savour of Food.—Condiments.*—The sacred dramatist has asked if there is "any savour in the white of an egg?" The use of some kind of condiment has obtained in all ages and amongst all nations; and there are some of them so essential to health, that they ought to be taken out of the category of *accessories* to food, in which they are generally ranged in works on dietetics, and placed amongst the regular aliments.

Salt is essential; pepper nearly so. The hotter

* Much has been said in deprecation of the early age at which the British farmer now aims to bring his cattle to market, as having the effect of feeding the public upon unsound and immature food, destitute of the savoury juices which formerly were acquired by age. There is some truth in this complaint; but on the other hand must be taken into account the high breeding and improved selection of stock for feeding purposes, by which means the flesh, though young, is so juicy, and the fibre so well separated by interstitial fat, as to compensate, in great measure, for the loss of those qualities which age alone can give. In a socio-political point of view, too, all is compensated for by the cheapness which the more rapid maturing of animals for the market produces; they not only consume a much less amount of food under the present system, but make room for a more rapid succession of relays, by which alone the increasing population of these kingdoms can be adequately provided for.

kind of condiments which are so much used in the eastern and western tropics are doubtless a necessity of the climate, and Nature has placed the materials of the stimulating curry in close proximity to the insipid rice, which no cookery can render palatable to the stomach without some savoury addition to it, if it be only rancid butter, or *ghee*.

The addition of stimulating condiments, sauces, &c., to substances which already possess a natural and pleasant savour is a dietetic blunder, being both unnecessary and injurious, as it is most probable that the savours natural to various dietetic substances are given to them for the purpose of exciting the nerves of the stomach so as to cause them to elicit a larger amount of gastric juice than would be produced by the contact of more insipid aliments.

The acid condiments, of which vinegar and lemon-juice are the best examples, are of universal use in facilitating the digestion of many articles of diet, amongst which are animal fibre, which they partially dissolve, oily substances, and hard-fibred vegetables. They also form combinations with the salts contained in these substances, which are of great service to the blood.*

AQUEOUS FOOD.—DRINKS.

Drinks, like solid aliments, are classified, and partake of the inconveniences of all classification—viz., that of imperfection. For the sake of orderly arrangement, however, we will consider them under the following heads:

* It is very seldom that the instincts of the palate will be found to run counter to the laws of animal chemistry as applied to digestion. Thus, the habit of mixing vinegar with oily substances, especially such as have a strong savour, is well founded; as is also the time-honoured apple-sauce with pork, goose, &c.; also the modern custom of mixing lemon-juice in the gravies used to wild-fowl, and certain internal and high-flavoured parts of animals, is found to answer.

1. *Aqueous;* watery, or natural drinks.
2. *Infused;* in which organic substances capable of solution have been introduced.
3. *Fermented;* including beer of all kinds; wine, lemonade, ginger-beer, &c.
4. *Distilled;* or spirituous liquors, in which alcohol exists as the main ingredient, and in an uncombined state.

Use of Fluids.—Thirst.—The necessity for drink will be understood as well from the urgency of the feeling which we call thirst, as from a consideration of the quantity of fluid always circulating in the animal tissues, and passing out of the body by means of evaporation and secretion. Not less than thirty pounds of fluid pass through the stomach alone daily; and although this is nearly all reabsorbed into the system, fresh supplies have to be constantly poured in to repair the loss from other organs. With regard to what passes away by means of the lungs and skin, we have data which are accurate enough for all ordinary purposes. From twenty to twenty-seven ounces are daily exhaled from the delicate lining membrane of the lungs, and about two and a half pounds are transpired by the skin. The fluid passed by the kidneys varies from a pint and a half to two and a half pints (of twenty ounces) in twenty-four hours. So that we may reckon that a healthy person, not in an actively perspiring condition, excretes not less than from five to seven pounds of water every twenty-four hours. Some portion of this fluid is derived from the inspired air; another small portion is perhaps absorbed by the skin; and a larger quantity is taken in with the apparently solid matters of the food. The full complement has to be made up by the direct imbibition of fluid by the mouth; and it is of what these fluids consist, and their normal quantity, that we have now to speak.

Thirst is the uneasy sensation caused by the want of fluid in the system. Although this sensation is occasionally deceptive, as when the mucous membrane of any part of the digestive canal—mouth, gullet, stomach, or intestines—is inflamed, or irritated by salt or any acrid food, in a state of health it is a much more certain guide of the wants of the system than that which the correlative feeling of hunger supplies. Perhaps we may state the average quantity required to be taken by a person not using very active exertion, and free from the vicious habit of slaking an artificially created thirst by drinking between meals, to range from two and a half to three and a half pints daily, taken at three, or at most, four times. Many persons do with less than this, never exceeding half a pint of fluid at one time. In the case of females who lead a sedentary life, the skin being less active and the breathing less frequent, the quantity of drink required is considerably smaller than it is in that of men. It is the neglect of this fact which brings upon many women that troublesome excitement of the kidneys, which, with them, are the chief outlet for superabundant fluid.

The uses to which drink has to be applied, previous to passing out of the body, are many and most important. Water is the great carrier of the body, constituting nearly 8-10ths of the bulk of the blood. The more solid substances, either dissolved or suspended in it, are by its means carried from one part of the organism to another, and new material is constantly being abstracted from the circulating fluid by assimilation, and as constantly added to it by digestion and absorption. Besides thus supplying the main current of the circulation, water has to replenish the waste of fluid by evaporation from those parts of the body which are exposed to the drying effects of air. The lungs, skin, and mouth

have to be constantly lubricated with water to prevent the parching effects of the loss of their natural moisture. The whole digestive cavity is also lined with a membrane from which is poured out a soft, bland, and mucilaginous-looking fluid, called mucus. Moreover, the great shut cavities of the body—the cavity of the chest—of the bag in which the heart is enclosed (*pericardium*)—the abdomen—even the brain itself—are wrapped in serous membranes, from whose surface a thin lymph continually exhales.

Are drinks Food?—Taking this survey of the uses of water in the animal economy, we shall be at no loss to answer the question as to whether drinks can properly be classed as *Foods*. Looking at the destination of most of the fluids taken into the body, and remembering the definition of food given at the outset of this chapter, no other answer can be given than this. Fluids are to be reckoned as food in so far as they convey nutriment into the system; whether that nutriment be merely suspended in them or in chemical solution in them, or the nutritive powers absorb the fluid itself, and attach it to the normal structures of the body. Water, forming the greater part of the blood itself, is constantly passing out from it, and being again absorbed into its current. This is as much a nutritive process as the building-up of the wasted flesh by new solid material, the one being as essential a portion of the organism as the other.

The difference in the nutritive properties of various drinks, therefore, will now fall to be considered, and afterwards any other properties auxiliary or conducive to the nutrition or well-working of the human machine.

Aqueous Drinks.—The type of all drinks is simple water. Its advocates tell us that it is the only *natural* drink of man, and call the habits of the

inferior animals before us to prove their assertion. But, like all such loose analogies, this proves too much. If we are to take the example of the lower animals for our guide in the choice of drink, we ought to do so in that of food. It will not be denied that the latter suits us better after exposure to some kind of cooking process, than when eaten raw; except indeed, in the case of the ripe fruits of the earth. The truth is, that Nature has provided the natural man with certain primitive and wholesome foods ready to his hand, such as the various fruits supply; and, as suitable to this primitive fare, with a bountiful supply of equally innocent drink in the water of springs and rivers. Advancing in civilization, that is to say, in the arts of subduing the earth to his use, man is permitted to raise his natural habits into a higher, or at least a less simple range; and therefore it is that by the art of cookery the exalted sensibility of his nervous system is gratified to an extent unknown to the savage; and he has employed himself in adding to the insipidity of water such substances as will gratify his palate in the transit, stimulate his digestion to increased vigour, enliven and cheer his moral sentiments, and exalt the perceptive faculties of his mind.

Without taking this view of the progressive use of more compound diet as civilization advances, it will be almost impossible, on physiological grounds, to justify the use of such drinks as tea and coffee, still more to resist the onslaughts of the devotees of total abstinence upon the stronger beverages of beer, wine, and distilled spirits. Food, drink, and clothing, are all adaptable to the varying circumstances in which we place ourselves in regard to natural objects; and their artificial preparation is but the *natural* result of the departure from primitive nature in both instances.

Water is seldom or never found pure on the surface of the earth. As it descends in rain, it dissolves a slight trace of ammonia and carbonic acid whilst falling through the lower atmosphere; and in its passage along, or through the earth, it dissolves a varying amount of salts, with a trifling quantity of organic matter. In the case of some mineral waters their saline ingredients abound to such an extent as to remove them from the category of plain drink into that of medicine.

There is a prejudice against hard water for drinking purposes, for which no physiological reason can be assigned. Indeed, impregnation with a small amount of the salts of lime or soda, with free carbonic acid, renders water much more stimulating to the palate and gives the sparkle so much admired in the waters of some localities. When the water is of extraordinary purity, as that of Malvern, it does not keep well when kept from contact with the earth.

Plain water is a general stimulant, especially to the digestive and urinary organs. When taken upon an empty stomach, it is immediately absorbed into the bloodvessels; and if the quantity exceed the real requirements of the system, the excess is quickly thrown out by means of the kidneys. The reaper or mower, sweating under the sultry sun, discharges nearly all he drinks (and it is not a little, from eight to twelve quarts of beer or cider being no uncommon daily allowance) by means of the skin. There is no doubt but he commits a physiological blunder in these enormous potations, for whilst he thinks that the more he sweats the more he *must* drink, the truth is that the more he drinks the more he *must* sweat.

There is still a prejudice existing against taking plain cold water when the body is heated, and many cases of serious injury to the health, and even of sudden death, are related as having been caused by

a sudden draught of cold water entering a heated stomach. Granted that *large* draughts of *very* cold water are dangerous when the body is heated, and especially if it be *fatigued* also, *moderate* draughts of water, not colder than 60°, are safe enough at all times; but more particularly if taken whilst exercise is proceeding. It is not easy to explain the destructive action of *very* cold water upon the stomach when the body is heated. It is a mistake to suppose that it operates by lowering the exalted temperature of the *stomach* too rapidly, as that viscus, like all the others, is always of the same temperature. In the cases which have occurred, it is very likely that the heart has not been sound, and that the shock of cold was carried by the intimate nervous connexion between them from the stomach to the heart, whence fatal spasm has resulted.

The regular imbibition of large quantities of pure water has the effect of hastening the metamorphosis, or change of tissue, in the body. Hence it is a practice which should only be had recourse to for special purposes. As a medicinal agent, accompanied with a great deal of exercise, it rapidly disintegrates the particles of the body, increases the excretions of all kinds, and makes room for a largely increased quantity of new material. If the digestive powers are equal to supplying this new material in good quality and in sufficient quantity, well. If not, all the destructive effects of over-exertion, of insufficient food—depression of the vital powers—must result. In the practice of the "water cure," as used by specialists, all these various results are found. Can we be surprised to hear of the very opposite results which different individuals experience in subjecting themselves to this mode of treatment; and can we fail to deprecate most strongly any reckless-

ness in its application? None but those who have thoroughly studied the subject upon the basis of a sufficient acquaintance with the recondite operations known to the most advanced physiology can be safely trusted to administer such an agent.

At meals, water should be drunk in *small* quantities at a time. To take a large draught just before beginning to eat is injurious in two ways—it retards the flow of gastric juice whilst the vessels are occupied in absorbing the water, and takes off the edge of the appetite by its bulk.

A tumblerful of cold water taken on rising from bed in the morning is known to facilitate the action of the bowels, and is quite a safe practice. It appears to operate by filling the vessels of the intestine, and thereby adding to their fluid secretion. Where the stomach revolts from drinking the water, the application of cold sponging to the bowels, and hard rubbing afterwards, as pointed out by the late Dr. Hamilton, of Edinburgh, will generally produce the same effect. The addition of a little alkali to the water, and impregnating it with carbonic acid gas renders it very soothing to the nerves of the stomach when irritated by the remains of an ill-digested meal; but when taken in excess, or soon after a meal, such drinks are hurtful by neutralizing the acidity of the gastric juice.

Infused Drinks.—In all countries, men have been in the habit of boiling or infusing various vegetable substances in water to be used either as stimulant, intoxicant, or medicinal agents. In our own country, before the introduction of tea and coffee, the poorer sort of people made large use of various herbs for these purposes. Sage, balm, horehound, rosemary, blackthorn, and the homely nettle, were much used; but the wealthier classes preferred their beer, mead, or strong waters. All these have now

yielded precedence in this and most other countries, to the Chinese leaf and Arabian berry.

Volumes would be required were we to depict the change in the habits and manners of all classes of people since the introduction of tea and coffee. If the extent to which the aspect of civilization has undergone a change the last century and a half, or even in the last fifty years, may be measured by the alteration in the diet and cooking of the people, equally is this the case in respect to their drinks. A strict logician might, perhaps, object to our crediting tea and coffee with all that true advancement in social intercourse which is characterized by more real courtesy, more delicate consideration for the feelings of others, arising from a larger perception of the operation of human passions, and of the necessity of restraint upon them, than that which the fear of consequences to self is able to induce. It may be objected that the diminution in drunkenness, for instance, is as much owing to the advancement of learning and the spread of knowledge amongst the mass of the people, by which mental excitement of a more healthy character than that which resulted from intoxicating liquors has been procured, as to the substitution for these objectionable stimulants of a drink whose effects are soothing and calmative, rather than exciting to the animal passions. Again, the advance of liberty, and the equalization of all classes before the law, have raised the standard of self-respect amongst the lower classes, who have found that to gain the respect of their superiors in station they must be moral, and to be admitted into their society they must become, to a certain extent, refined.

The truth of these objections to the assumption sometimes made, that tea and coffee have proved the greatest social ameliorators which have been intro-

duced for many centuries, cannot be denied. No doubt many circumstances have acted *intercurrently* with these *humanizing* beverages; and it is hard to discriminate amongst the influences to be attributed to the several factors in social progress, where all are intimately connected and assisted by each other in bringing about the conjoint result. But that social intercourse of an elevating character, extensive diffusion of a love for science, increased reliance upon self help and individual exertion, to say nothing of the grand results of the ambition to excel, have had an intimate connexion with tea and coffee drinking, with tea-meetings, soirées, lectures, and mechanics' institutes, no observant person can doubt.*

If we advert now to the physiological effects of tea and coffee, we are struck at the outset by the extraordinary similarity of the constitution of their active principles, and by consequence, in their effects upon the system. This similarity, almost identity indeed, is the more remarkable, looking at the great difference in the plants which produce them, and the parts of each in which their active principles

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* Notwithstanding that it is now some two hundred years ago since tea was introduced to the court and the higher classes of society in England, there are people still living who can remember its first introduction into some remote parts of the country. A relative of the author's, dead not more than thirty years, was the person in his village to whose house the ladies had smuggled the first pound of tea. Accustomed himself to the *wholesome* potation of strong ale, morning, noon, and night, he was equally desirous that the females of his family should continue to enjoy the benefit of the same beverage; and having discovered, was determined to make away with the intrusive trash. Taking the pound of tea to the well, he emptied it into it, caring little for the spoiling of the good water of which he took care never to partake in a *raw* state. When the time arrived for making the tea, and the costly material was nowhere to be found, he told the good dame to take her kettle to the well and dip it therein, as he had already made the tea! The consternation of the village ladies may be imagined, and the next clandestine supply was doubtless taken better care of.

reside. That the leaves of a plant so peculiar to China, that until lately it could scarcely be said to exist out of that country, should, after a process of drying, yield an aromatic substance with identical proximate elements to those of the berry of a tree, which, though at home in Arabia, readily thrives in each quarter of the globe, is almost an anomaly in the vegetable world. The active principle of tea is almost identical with caffein, its analogue in coffee; and the volatile aromatic principles of both which over-roasting or boiling dissipates, produce very nearly the same effects upon the stomach and the nervous system.

Taking at present the effects of tea and coffee with reference to those points in which they agree, the most obvious are the excitement of the nervous force, with increased delicacy of perception and the power of sustaining the attention beyond, probably, what can be attained by any other physical agent. At the same time that this effect upon the sensual and intellectual portions of the brain takes place, the action of those which regulate the great vital functions—breathing, circulation, common sensation, and voluntary motion—is not depressed either at the time, or after the excitement of the mental powers has passed off. It is in this respect that tea and coffee contrast so favourably with alcoholic stimulants; which, the stronger kinds at least, when taken in more than a very moderate quantity, leave a feeling of depression and lassitude after the excitement of the first operation has passed away.

Whilst the gentle excitation of the nervous forces, chiefly of the mental functions, is all that results from the use of good black tea, green tea and coffee produce other effects which are referable to some of the other functions. Green tea is generally known

to excite the *whole* system, increasing the pulse, hastening the breathing, and inducing restlessness and motility of the muscles, with sleeplessness, for several hours after taking it. Coffee, if strong and fresh roasted, possesses the same powers. Green teas, when only gentle stimulation is required, may be mixed with black in the proportion of a quarter or a third of green, and it should not be allowed to stand more than a minute or two after being made, otherwise the delicate and delicious aroma upon which its enlivening effects depend, is dissipated and lost. Taken in this way, mixed tea partakes of the good attributes of either sort. To the exhilaration of the spirits and increased clearness of perception, are added a slight fillip to the heart's action, which is followed by a gentle glow or perhaps a slight perspiration. Digestion too, although not hastened, (indeed it is rather retarded,) is assisted, and its later stages rendered easier and productive of less uneasiness, by a cup of good tea taken *two or three hours* after food. This latter use of tea is the more valuable in the case of debilitated constitutions, or convalescents from diseases which have lowered the digestive powers of the stomach; and more particularly in painful affections of that organ or of the intestines. Indeed, it is in these cases that a small cup of tea taken a little before a meal is more often provocative of appetite than any other substance or appliance.

The popular saying which attributes to tea (more than to coffee) both a warming and a cooling effect has been charged with inconsistency. It is, nevertheless, a true saying, and easily explicable. When the body is cold, warm tea or coffee excites a determination to the skin, and if assisted by a warm atmosphere, will produce perspiration. All travellers, whether coachmen, drivers and guards to railway

trains, sailors, and even our Arctic voyagers, declare that the warming effects of tea, and especially of coffee, excel in permanency those produced by alcoholic stimulants. The feeling of hunger is especially depressing when the body is also exposed to external cold. This feeling is deadened and often altogether removed, for a time, by tea or coffee. And although the feeling of hunger is thus benumbed, so to speak, the power of relishing and digesting food still remains and is readily excited.

A cooling effect is, on the other hand, produced by tea when the body has been heated by exercise. It relaxes the skin and allows the heat of the body to be abstracted by means of evaporation. Thus tea is first heating, and afterwards, in hot weather, cooling.

It is especially in the latter part of the day that these effects of tea and coffee are most observable. When body and mind are fatigued and jaded by any long and uninterrupted strain upon the powers, then it is that these liquids prove most refreshing and invigorating to the system. The muscular force returns, the mental perception and judgment clear, and attention is deepened and intensified.

After long watchfulness, as by the bedside of the sick, tea is most refreshing. Nurses seem by instinct to get up an early tea, at four or five o'clock in the morning, after watching all night. To the invalid himself, who after tossing to and fro in wretched sleeplessness, perhaps the long night through, is quite worn out at early morn, a cup of tea, with some light nourishment, will often induce sleep later in the morning.

There is reason to believe, from physiological data, that, taken for breakfast by healthy people, tea is not so useful a beverage as coffee. The vital powers, lowered by sleep, are often somewhat sluggish on

first rising in the morning. Coffee, as the greater stimulant of the two, excites the vascular system, and through it, the digestive powers. It also has the effect, with many people, of promoting, whilst tea retards, the operation of the bowels. That the former is the case is proved, I think, by the habits of the two sexes; women, if left to themselves, preferring tea as the milder, whilst men affect coffee as the stronger stimulant. Working men almost invariably assert that they find coffee the more sustaining and nourishing of the two, and this doubtless arises from the fact that coffee retains the food longer in the stomach and bowels than tea, and so, by *retarding* digestion, defers also the return of the sensation of hunger.*

As a nervine stimulant, coffee should not be given to very young children, as it tends to over-excite the brain, and, in large quantity, to bring on convulsions.

There is a notion prevalent amongst ladies that coffee darkens the complexion; and the impression seems to be strengthened by the fact that our French neighbours, who are almost exclusively coffee-drinkers, present much more swarthy and less transparent skins than our *fair* countrywomen.

Are there any people now remaining, who still raise their voices against tea, stigmatizing it as a slow poison, as our beer-drinking grandfathers did? Merely on the supposition that, in some remote districts, this race may not yet be quite extinct, or that some few obstinate adherents of the "bona tempora acta" may still charge against the use of tea

* At Mechanics' Institutes, Working Men's Clubs, and other places of dietetic resort for working men, twenty cups of coffee are sold for one of tea, both morning and evening. Their wives and daughters, on the other hand, affect tea meetings and soirées; the lighter stimulus of tea seems to suit their more delicate organization better than the grosser one of coffee.

all the degeneracy (?) of the present race of men and women, a few words must be said about the corporeal effects of tea and coffee.

In what manner the active principles of tea and coffee operate, so as to produce the effects upon the nervous system just mentioned, is still wrapt in much obscurity. The very laborious and self-denying experiments of Böcker and Lehmann in Germany, and those of Dr. Edward Smith in this country, seem to establish the following conclusions, which are here quoted from Dr. Chambers:*

1st.—*Tea, in ordinary doses, has no effect upon the amount of carbonic acid expired, the frequency of the respirations, or of the pulse.*

2nd.—*When the diet is insufficient, tea limits very much the loss of weight thereby entailed.*

3rd.—*When the diet is sufficient, the body is more likely to gain weight when tea is taken than when it is not.*

4th.—*Tea diminishes very much the loss of substance in the shape of urea.* (Disputed by Dr. E. Smith.)

5th.—*The loss by perspiration is also limited by tea.*

As compared to these effects of tea, coffee still further protracts the operation of the digestive organs, whilst it increases the pulse and excites the nervous system to a higher degree. It also diminishes the quantity of carbonic acid expired, and also that of the solid matters removed from the system by the various excreting organs, to a larger extent than tea.

This diminution of the solids and fluids daily excreted from the body amounts, according to Dr. Brinton,† to about three-quarters of a pound, half of which are solids, and half water.

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* "Digestion and its Derangements," 1st Ed. p. 247.

† "Food and its Digestion," 1861.

There are individual differences amongst persons as regards their use of tea and coffee, which can only be known by each one's own observation. Coffee, if strong, stimulates more than tea, *generally*, whilst a few are more excited by tea; coffee promotes digestion with some, with others, especially if taken soon after dinner, it produces flatulence and oppression. *Strong* coffee taken soon after dinner, is always prejudicial as interfering too much with the process of digestion.

Tea and coffee, then, diminish interstitial change—that taking down and replacing of the particles of which the body is composed. In other words, they make less food do the work of the much larger quantity which, when water alone is drunk, is found requisite. They appear to be *real food* to the nervous system, strengthening its tone, and lengthening its term of endurance. The Chinese always assert that life is prolonged by tea.

These beverages are, therefore, most useful to all classes of society. To the active-minded and studious they give the means of increased mental energy and perceptive power; to the manual labourer, who, with their aid can do more work with the same quantity of food, or, if food be deficient, can endure hard labour with less loss of muscular strength. In fine, they cheer and soothe the ruffled spirits; blunt the edge of carking care and sorrow; enlarge the sympathies and tender emotions of the soul; whilst they enable the judgment to take a firmer grasp, the imagination to soar to its highest flights.*

Fermented and Distilled Liquids—Alcoholic Beverages.—If we were here writing a complete system

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* It would not interest the general reader to detail here the discussions which the physiological action of tea and coffee has given rise to in scientific circles, chiefly with regard to the apparent

of dietetics, suitable to every variety of constitution and every peculiarity of habit, it would be necessary to review in detail the qualities and effects of each kind of beverage which falls within the two classes here placed together. But, as nothing more can be attempted in this place than an epitome of the physiological action of this class of drinks upon the system generally, a limitation of design to the demarcation of the broad principles from which each one must particularize for his own individual case, becomes inevitable.

Beer, cider, perry, and the various kinds of wines, as fermented liquids, present as great differences amongst themselves as they do with regard to brandy, gin, whisky, or other distilled spirits in ordinary use. The difference in the action of each is one of degree rather than of kind: and although the varieties which they exhibit in their operation upon the same person are many, and, upon differently constituted individuals almost innumerable, they are facts bearing upon minute dietetics rather than upon the actions of the great functions of the organism.

When a judge, in an important trial, desires the jury to dismiss from their minds any opinions they may have formed upon the case from information derived from "out of court," he supposes that they may have been guilty of prejudging it upon one-sided, inaccurate, or insufficient evidence. This caution the

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anomaly which they present in reducing the amount of solid food, whilst they increase the energy of most of the functions. According to the doctrine that life consists in change, and that the rapidity of that change is to be taken as the measure of the amount of vitality in different individuals, this result is self-contradictory, and therefore to be received with suspicion. The truth is, however, as will be more fully detailed in speaking of the same effects as produced by alcoholic drinks, that this assumption of the nature of the vital functions is too arbitrary and limited in its views, inasmuch as it overlooks *quality* of action in fixing attention solely upon *quantity*.

physiologist has to give to his readers when about to present to their minds facts upon which a judgment should be founded in the matter of alcoholic drinks. They have probably heard the question in debate argued "out of doors" in all sorts of places, and by all sorts of men, who have all got their own version of the story, and are anxious (as who is not?) that it should be received as *the* only version deserving of credit. Not only so, but they have listened perhaps, to arguments for and against the use of these liquids, which have little or no reference to their primary, natural, or sensible employment; still less are they based upon any trustworthy data with reference to their action upon the tissues of the body. When religion and morals are declared by a party to depend for their existence upon the abolition of "the sinful traffic in intoxicating drinks," the mere physiologist, who limits his inquiries into their properties and mode of operation, is put out of court. The use of any agent in the world, no matter what its properties may be, might be forbidden upon such principles. The higher interests must always outweigh, and even supersede, the lesser, *provided they are incompatible with each other*. But if it is abuse, and not use, of these agents which brings them under the ban of the moralist, it is the duty of the physiologist to point out where the one begins and the other ends.

It may be taken for granted that a universal habit cannot have pervaded almost all civilized humanity for long ages without its having been founded upon some real want of our nature. Even the spread of the modern habit of smoking, in the rapid manner it has done, is held to testify to the fact that there is *some* virtue in tobacco. This notion favours the assumption that the benefits to be derived from alcoholic drinks, in some way, exceed the injury; and that although a small minority is irretrievably ruined,

the majority are cheered and supported in the performance of their duties, thus leaving a balance already in favour of their proper use, and giving promise of a time when that use shall no longer be questioned from the sad consequences of their abuse.

What the physician has to do with reference to fermented and distilled liquors is, to study their effects upon the system in health and disease, at different ages, in diverse temperaments, and under the varying circumstances of climate, temperature, and kind of employment. He will thus be able to determine at what times, and under what circumstances, their use is beneficial; and when, and under what conditions, they are injurious. For although the physician is quite competent (indeed in many respects he is more fitted than any other person) to give a trustworthy opinion upon the social and moral aspects of these drinks, the solution of the question of their suitability to the due performance of the bodily or mental functions, and whether the use of them, although apparently beneficial at first, may not prove disastrous to the organism in the long run, falls entirely within his province.

To enable us to see our way through the thick mist of prejudice which has been cast around this subject, to a pretty just conclusion as to the effects of alcohol, in any form, both upon mind and body, we possess, fortunately, some very accurate and detailed experiments. To the German physiologists, chiefly, belongs the merit of having carried out the experiments necessary for this purpose with untiring patience and much self-denial and devotion. Amongst others, Dr. Böcker, whose researches into the analogous effects of tea and coffee have been already quoted, has given details of his experiments and conclusions therefrom, which, although we may not admit that they settle every question which may be raised

on the subject, yet are sufficient to satisfy our minds upon the more general effects which the class of alcoholic drinks produce upon the human frame.

Physiological Effects.—These effects are divided between the nervous system, on the one hand, and the vascular and muscular on the other. To judge of them, the experimenter should be careful to use the same diet, to go through the same amount of work, and generally to place himself in those circumstances which he considers normal to his system.

Upon the Intellect.—The first effects of any alcoholic drink taken upon an empty stomach in the early part of the day, are an almost immediate feeling of exhilaration of spirits, and more rapid flow of ideas; the perception being heightened, perhaps, in intensity, though not in accuracy. This pleasurable state does not increase, if only a single small dose of stimulant has been taken; and after a little time the mind subsides into its usual state. If now the dose be repeated, or much increased, still without eating, the pleasurable excitement is extinguished, the sensations are blunted, and the thoughts somewhat confused. It is in this state that the mock courage which ignores difficulties or danger takes the place of that exaltation of the hopeful and enterprising faculties which the first moderate dose produced. It is upon the false appreciation of his position which this state induces in the habitual drinker, that he succeeds in blunting his sensibilities to the keen edge of scorn and contempt, and is able to brave the evils which he no longer possesses sufficient energy of will to mitigate or remove.

Of course it may be said that the brightest and happiest moods into which the mind can be thrown by alcoholic stimulants, are produced simply by blunting its sensibility to care, sorrow, or anxiety, by a narcotic agent; that these anxious feelings, which

for a time we seem to have annihilated, have their certain NEMESIS when the effect of the stimulant narcotic has passed away; and that the awakening of the drinker to his load of care, all uneased and undiminished by exertion of the preceding day, is one of the most terrible of retributions which his outraged moral nature can inflict. Of the misery of the fool's paradise which a continued resort to wine or spirits for the purpose of drowning care and softening self-condemnation for putting off the evil day, for delaying to confront and encounter difficult circumstances or anxious decisions induces, none but those who have been unfortunate enough to be landed therein, can form any adequate conception.

These are the effects upon the intellectual faculties, of taking alcoholic drinks, more especially of spirits, at irregular periods, and without other object than that of obtaining from them their exciting operation.

Upon Sensation.—Their action upon the function of sensation varies very much according to the quantity taken at one time. Even in the smallest quantities, persons of very delicate organization experience an immediate loss of the nicety of touch, of appreciation of the intricacies of musical sounds, of judging of such qualities as roughness, smoothness, colour, and the like. Hence, artists, artizans in fine and delicate machinery, and all who have to exercise great delicacy of perception, abstain from these drinks during the time in which they require their sensitive powers to be in the finest order.

Upon Locomotion.—The organs of motion and locomotion are very perceptibly influenced by alcohol. There is a stiffness about the jaws, and rigidity of the eyelids, which even a very moderate dose induces, especially in those unused to stimulants. Increased quantities cause a numbness of the skin, deprive the fingers of their fine tact, and soon the gait becomes

unsteady, and the sight uncertain. It may be said that this is drunkenness. Not so. It may indeed be called *intoxication*, because that word properly represents only the *poisoning* of the system by the narcotic effects of alcohol; but the power of thought and judgment may be but little diminished, whilst the motor system is thus "all abroad."

Upon Digestion.—The effects upon the digestive organs of this irregular or objectless use of alcohol are very marked. Loss of appetite succeeds to a temporary, very temporary, increase of it; nausea and flatulence are produced by food, showing that the secretion of gastric juice is interfered with. The continuance of this state of the digestive organs robs the system of nourishment; and prostration, debility of the muscular power, with despondency of mind and blunting of all the natural affections, succeeds. Now arrives that state of affairs which can only be endured by a continued recurrence to the evil habit which produced it; when the morning dram is habitually required to remedy the prostration which comes from the last night's hilarity; which lasts a longer or shorter time only according to the quantity of vital force originally laid up in the constitution of the individual; and which, in a time that is always short, however long it may appear to the life-weary victim, leads him on to his miserable end.

Upon Nutrition.—Let us now turn to the experiments of Böcker, Lehmann, Edward Smith, and others, to see what demonstrable changes are produced in the organism generally by the *habitual* use of alcohol. Here we find a curious, and by many, no doubt, all-unexpected analogy between the effects upon the tissues of the body produced by alcohol, and those which we have already noted as resulting from tea and coffee. They are :—

1st. That the expiration of carbonic acid gas from

the lungs is diminished (although Dr. Smith's experiments throw doubt upon this).

2nd. That the urinary secretion generally, and its principal constituent, urea, particularly, are diminished by no less than $\frac{4}{10}$ (Böcker).

3rd. That the perspiration is reduced in quantity.

4th. That extremes of temperature are not so well borne under them as by total abstinence.

5th. That, as a result of these effects, the tissues of the body are not renewed so rapidly as when water only is drunk, and the blood retains within it more effete (worn-out) material; though in other respects it does not appear to be deteriorated by a very moderate allowance of alcohol.

6th. That alcohol passes into the system unchanged, and is removed from it in the same state by the lungs, skin, and kidneys, chiefly perhaps, by the former, as a consequence of its unchanged condition.

Argument of the Teetotaller.—Now all these physiological effects, which are pretty much the same in kind, although differing in degree, according to the kind of drink, (always diminishing as we descend the scale from ardent spirit to weak beer or light wines,) point towards a diminution in nutrition of the various tissues of the body, particularly of the muscular. And hence the great argument of the teetotallers (if they would but abandon that ugly word!) that not only do these beverages afford no nourishment themselves to the system, but that they are the cause of its deriving less from the food that is eaten, than would be got out of it by drinking water. Moreover they contend, and no doubt truly, that more solid food is assimilated by the system by water-drinkers than by those who use even a moderate quantity of beer, wine, or spirits. The teetotal lecturer evaporates a pint of strong ale and exhibits to his audience the few miserable grains of solid sub-

stance remaining, which can be called nutriment. He then asks how much beef or bread might have been purchased with the cost of this pint of ale, and holds up his half-pound of meat, or half a loaf of bread, in answer.

But here commences the tug of argument in the contest between the total abstainer and the *moderate* drinker. Says the teetotaller, What is the amount of force which I can get from the muscle, or from the brain-substance, which this quantity of meat or bread will build up? Shall I not possess a greater store of physical power than you who have deprived yourself of that quantity of muscle? Shall I not be able to sustain a greater demand upon my mental faculties, which the half-pound of meat will recruit, than you who have taken no new substance to repair the loss the brain sustains by thought? What has your pint of ale, or glass of wine (cost about the same as my food) done for your muscle or your nerves? It has flogged the natural functions into unnatural activity; it has applied the spur to the tired horse, and got out of him a few more miles, or a faster pace, but only at the expense of the next day's exhaustion. It has converted muscle into mechanical force, but it has not assisted the vital forces to replace the muscle. This, I believe, is the gist of their argument. It is based upon an assumption—an assumption, however, which only takes for granted the dogmas of the most popular vital chemistry of modern times, and which are as familiar in the mouths of physiologists as household words. Is not, say they, the body continually undergoing change? Do we not change every particle of our structure ever *so* often? (time unknown.) And is not the amount of this change, its rapidity and extent, the exact measure of the vital force employed; and is not therefore a person in whom these changes go on more rapidly than in another individual, living

more completely, in fact, doing more vital work than he?

The validity of the teetotal argument, I say, depends upon the truth of this assumption. But is it true? Is *quantity* of change to be only thought of, and are *manner* and *quality* of no account? In replying to this important question, we must bring into the account the operation of tea, coffee, various spices and condiments, as well as of beer, wine, and spirits. All that we know of the action of any one of these upon the nutrition of the body goes to prove that they enable a man to continue his daily labour of digestion, nutrition, muscular or nervous energy, with a *less* amount of food than when they are not taken; that, in fact, they make a little go a good way. This effect is produced by their *retarding* the process of digestion, whilst they would seem at least not to diminish (do they not increase?) the quantity of that portion of the food which is absorbed into the system. Under their use, less excretion, both by the kidneys and by the bowels, takes place. This shows that a larger proportion of what *is* eaten is digested and retained under their influence, than when no stimulating drinks are used.

But the teetotaller continues his argument, and replies, Granting this to be so, and that these drinks—tea and coffee a little, and beer, wine, and spirits more—enable you to do a certain amount of brain-work or body-work in the twenty-four hours, would you not do more than this if the drink were exchanged for bread and meat, to be converted into muscle, from which a still larger quantity of work would be obtained? The affirmative is only partly true. Provided the digestive organs *are equal to the strain upon them*, and that the extra allowance of albuminous food can be digested and assimilated, you will get, perhaps, the largest amount of vital force

which, under any circumstances, can be obtained. But if the frame be weakly, if only a moderate quantity of food can be got into the system, then the little fillip which the glass of beer or wine can give is necessary, and the nervous energy, which presides over all the processes, is exalted and fortified.

On the other side.—And now the question remains, Is change always equal to force? If so, the larger the individual and the better his digestion, the greater will be his powers, whether they exhibit themselves in muscular exertion or in mental activity. No doubt, comparing himself with *himself* at various times, this is so. When he can digest the largest quantity of food, then he is capable of the greatest exertion which lies within the circle of his ability. Another person may not be capable of eating so much, or of digesting it with the same ease. Must he be placed lower in the scale of vitality—be considered to live more slowly than the other? Is it not conceivable that some men may possess the power of keeping the tissues longer in use than others, and part with a less quantity at every act of muscular or nervous exertion? One workman will get through more work in a day than another, but it may not be so well done, nor equal in money value the performance of the latter. *Quality* of work, whether of body or of mind, is as important an item as that of *quantity;* and the question is, Are certain individuals able to do their work better, to go through their daily toil with more comfort to themselves, and with a smaller strain upon their nervous systems, when using a *moderate* allowance of stimulants, than when practising total abstinence from them? If the general experience of a large number of trustworthy and conscientious persons goes to answer this question in the affirmative, the doctrines of teetotalism no longer trench upon the

domain of physiology, but must be passed on to the more restricted one of pathology, of bodies diseased and minds disordered, through the medium of *excess* in the use of those beverages.

Let us take another look at the process of nutrition and waste: the one as building up the solid substance of the body in which force resides, and the other as keeping pace with, and immediately resulting from, the expenditure of that force, whether under the form of muscular motion, mental or moral effort, or in the performance of the internal vital functions themselves. Are there any substances which, though not adding any appreciable atom to the real bulk of the body, and therefore cannot be directly nutritive, yet tend to consolidate and strengthen the vital cohesion, so to speak, of its component parts, and render them less liable to the destructive effects of wear and tear? just as the mortar used in building, though not required as a part of the wall itself, is serviceable in holding together and consolidating the materials composing it, and in a manner which could not be attained by any other means. The substances which have been denominated *accessory foods*—salt, vinegar, spices, tea, coffee, beer, wine, spirits—all seem to operate in some such way. We should, however, mislead the reader if we should induce him to suppose that these substances act as real foods by becoming part of the organism. They do not. Their proper designation would be *accessories to nutrition*, acting beneficially upon it—as air, exercise, and moral emotion may be supposed to do—by directing the nutritive processes into the right channel, and supporting and assisting them in the work of renewing the bodily substance.

Here we must advert to the part which the nervous system undoubtedly plays in conditioning the rate and quality of all the nutritive operations.

The heart and bloodvessels, the lungs, the stomach and intestines—indeed, all the great vital organs—are supplied by it with energy to perform their functions, and those functions are regulated by the condition of this nervous force. Moreover, the state of the brain itself, even of those parts of it most remote from those portions which govern the mere animal faculties, exercise great influence over the digestion and other nutritive processes. Joy, hope, cheerfulness, conscientiousness, all reflect their moral excellences upon the bodily functions, and stimulate and strengthen the organs in the discharge of their duties.

If tea and coffee, and beer and wine, cannot add any tangible material substance to the tissues to increase their powers, may they not impart some more recondite force—like electricity, for instance—which may operate as a stimulus to their action, that of the nervous system in particular? The immediate exhilaration of the spirits, the quick renovation of the exhausted powers, both of body and mind, and the fillip given to the digestion by a small quantity of these drinks, seasonably taken, seems to point to some such influence being imparted; and the bad effects of too frequent repetition in causing exhaustion of the nervous force strongly corroborates such a view.

Here we must leave this argument. The thoroughgoing total abstainer, having his mind impressed with the sad consequences of abuse, will still be prejudiced against the use of alcoholic drinks, and will continue to tax his ingenuity (having enlisted many clever physiologists in his cause) to prove the fallacy of those impressions which satisfy the minds of his opponents that these drinks are, under proper regulations, not only innocuous, but salutary.

Alcoholic Drinks: when serviceable.—It behoves

us now to glance at the circumstances under which alcoholic drinks *are* considered by unprejudiced observers to be serviceable, and the kinds which are most useful in different constitutional states.

It may be at once granted to the total abstinence men, that the healthy and robust organism, doing no more work, either in the body or out in the world, than it is fully capable of accomplishing, needs no stimulus from alcohol in any shape. Provided sufficient food, particularly of the albuminous kind,—meat and bread—can be digested, to supply the waste which any amount of exertion to which it is subjected can produce, nothing more can be wanted, and stimulating drinks are not only useless, but *may* be hurtful.

It is now sufficiently proved by experiment, that *some* labourers of all kinds—agricultural, mining, and even those who are engaged in the most laborious of all, iron-puddlers—can do as large an amount of work in a day, many larger, without *drink* than with it. The fact must be noticed, however, that these teetotal labourers are generally picked men, of great strength of constitution, and, above all, with no flaw in their digestion. So long as they can eat largely, they require no stimulating drinks. Remove this, let illness or natural constitution lower the power of digesting and assimilating albuminous food, and the teetotaller is immediately placed at a disadvantage compared with the moderate drinker.

For brain-work again, so long as it is moderate, and quite *within* the powers of the individual as to time and scope, *the digestion being good*, neither beer, wine, nor spirits are required. Young persons of either sex, clerks whose work is mechanical rather than intellectual, and manual labourers in-doors, are in the same category. So also, persons who are a

good deal in the open air, if their toil be not excessive, do very well without these stimulants.

Were we to say that all other classes of persons and individuals are *benefited* by the moderate and discriminating use of alcoholic beverages, we should perhaps exceed the truth. There are many who, if they cannot compete with their fellows in the amount of manual work, or in the conduct of affairs requiring constant attention and thought, should be content to renounce the ambition of belonging to class A 1, and quietly and modestly content themselves with a lower place. Their digestive powers are probably only moderate, yet healthy; their constitution of body or mind is only of second-rate quality; and the circumstances of air, exercise, and other recruiting agents in which they live, are not of the best. For such persons to strive to emulate their more highly organized, or more fortunately placed compeers, under the stimulus which alcohol can give, is simply suicidal. Equally good work cannot be got from damaged as from perfect machinery, and to apply more steam, in the shape of these drinks, is only to drive the machinery on to more rapid destruction.

In weak Digestion.—When, then, may beer, wine, or spirits be taken? The former two when moderate muscular strength is required; when the food is deficient in nutritive qualities; or when, from original or acquired weakness of the stomach, the food is digested with difficulty. Beer and porter seem, by common consent, to be most suitable for bodily exertion, especially if it be carried on in the open air. Wine seems to agree better with the sedentary, and to aid a weak digestion more than beer. The brain-worker, who although his powers may be great, is exhausted by their employment, wants wine to sustain them under undue exertion; and perhaps beer also to give stamina to the muscular substance. The

use of either, however, must to a great extent be regulated by individual experience, and by acquired and inherited habit. The descendants of wine-drinkers certainly appear to bear wine in larger quantities than others, without injury.

Of the use of wine to habitual invalids, or during convalescence, it is not my purpose to speak in this place. It comes within the domain of medicine, and belongs to the art of *recovering*, rather than to that of *preserving* health.

The artificial habits of society are to be charged with a great deal of the necessity for wine and other stimulants. Irregularity in the time of meals, and of the quantity of food taken at them, by deranging the digestion and producing bodily exhaustion, leads to the use of stimulants where *food* is the thing required. The gourmand, who, although he takes great quantities of substance into his stomach, yet from its vicious preparation is able to derive but little real nutriment from it, has recourse to wine for the purpose of qualifying, as he calls it, his food for digestion (good eating requires good drinking, is his motto), but really to rouse the stomach into a temper to attack a mass of material which only disgusts and annoys it. Supposing this organ to be endowed with personal sensibility, how astonished must it often be to find thrust into it matters of the most heterogeneous kind, and in an order which must utterly confuse its form of attack, and indeed, frequently induce it to give up the attempt in despair.*

The orderly and well-considered use of stimulants

* In a lively little work called "The Memoirs of a Stomach," published a few years ago, the perplexities of this organ, under the discipline of a *bon-vivant*, are graphically depicted. Taking dinner, for instance, when the organ is ready for a grand attack upon solid food, it finds the first thing that comes down is a lot of soup, often greasy and disrelishing, which effectually prevents the walls of the

is quite another thing. The comfort to be derived from their use, the assistance to the digestion, or as a substitute for food, depend upon judicious management. At the beginning of this section I have stated the physiological effects of the reckless and objectless use of these drinks. Would it be too much to say that the results derived from their temperate, regular, and judicious employment, equal in value, to the wise and sober, the injuries, misery, and destruction which, to the intemperate, spring from their abuse? I will not say. Nevertheless, it is the part of the physiologist, of the physician, to procure for his patients all the good which their circumstances can derive from the former, without making himself in any way responsible for the sad effects of the latter.

Children, indeed no young persons, should habitually take alcoholic stimulants, except under medical direction. Women in health require them only to recruit the flagging system under anxiety, maternal cares, or real hard work. Long hours

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stomach from coming into close contact with the solid materials which follow. A glass or two of wine increases the bulk of liquid. Then comes a lump of fish, followed by more wine. Now, when, not knowing what is to come afterwards, the organ has begun to do its best with the solids and fluids, comes the real enemy—the solid meat with vegetables with which it would have been delighted to cope in mortal contest, eludes its grasp, being carried hither and thither by the rolling waves of soup, wine, and dissolved fish. The contest becomes an unequal one, and requires more exertion and a longer time than should be required to enable the stomach to gain the victory. But the evil does not end here. To increase the quantity of animal food derived from the main "pièce de résistance," entrées, game, and other solids come down, still further disheartening the stomach in its labours, and rendering the contest more unequal. Jaded, however, and ill-treated as it is, it resolutely endeavours to do its utmost: when lo! having disposed of the fluids which embarrassed its movements, and having come to a hand-to-hand fight with fish, beef, entrées, game, and the rest, the tables are entirely turned against it, and the enemy is recruited by a quantity of pudding, jelly, blanc-mange, more wine, fruit, and all sorts of sugary abominations.

of confinement to the work-room or school-room exhaust the nervous system, and a moderate stimulant is then required. Beer, taken with meals, not more than half-a-pint twice a-day, is generally the best. Where the appetite fails from want of fresh air, the bitter Burton ales or light dry sherry are the best drinks.

Old people generally *require* a small allowance of some stimulant. Their nutritional functions are often, either from badly managed diet, or disease, below the demands made upon the body or mind when activity is still continued. In these circumstances, a little wine for the educated, or good beer for the manual labourer, is of great service. It is in such cases that a small quantity of spirits, taken in milk or some light nourishment, is of undoubted value in rousing the dormant powers and stimulating the stomach to digest the morning meal. It is with great reserve that the physician ventures to give any *general* recommendation of ardent spirits for any class; but certainly these old and weakly frames are, of all others, those to which strict physiology would excuse the indulgence.

The best time of taking them.—Then as to the time of taking alcoholic drinks. All experience goes to prove that they are much less noxious when taken late in the day than at other times. Absorption is so rapid when the stomach is empty, that, if taken in that state, particularly in the morning, the spirit is immediately brought into contact with the brain and nervous system, which it quickly deranges and oppresses. Repeating the dose adds more than doubly to the ill-effects; and anything like a continuance of the habit is sure to lead to disorganization of the liver, kidneys, or other important organ, and to early death.

It is a bad thing to take stimulants during the

day *in repeated small quantities.* By so doing, the nervous system has no time for reaction against their effects, and soon all benefit from their occasional use is destroyed by the system becoming habituated to their noxious influence. When over-exertion of either body or mind demands the use of stimulants out of the usual habit of taking them, they should be accompanied with food. If they are required between meal hours, a sandwich, or a little soup, or even bread-and-butter, should be added. By this plan, the spirituous portion of the beverage will be detained longer in the stomach, exciting digestion, instead of being suddenly absorbed into the system, which happens when beer, wine, and especially spirits, are taken unaccompanied by food.

But the proper way of taking stimulants (reckoning under that term beer, wine, and spirits) is at the usual meal hours. With luncheon and dinner, or, if the dinner be early, with supper, a fair quantity of beer or wine may be taken according to the wants of the system, as indicated above. Whether wine or beer be the most suitable can only be known by acquaintance with the individual constitution; but, generally speaking, for work in which the intellectual powers are much exerted, and especially if nicety of judgment or delicacy of fancy be required, the lighter kinds of wine, as good claret or light sherry, are the only suitable stimulants. If the occupation be much out of doors, and muscular effort the principal exertion, beer or porter will do better; their effects being more slowly developed, and lasting longer.

From what has preceded it will be gathered that whilst the habit of using stimulating drinks is so ingrained in human nature that it is never likely to be discontinued, every advance in true civilization equally tends to restrict their use within

narrower and narrower bounds, and to supersede it altogether with an ever-increasing number of persons. The abandonment of the excessive use, which is abuse, of intoxicating drinks, will be found to fortify the argument for their moderate and physiological employment. When drunkenness is abolished by the advance of good manners, and by the elevation of mind which demands more intellectual stimulants than drink can give, the moderate use of alcohol to assuage pain, to remove exhaustion, to soothe care and anxiety, or to blunt the edge of bitter disappointment, will find few opponents: teetotalism will die a natural death from want of the opposition which feeds it. In the meantime, *one caution:* he who depends upon the mock courage which drink gives for facing difficult circumstances, or performing unpleasant duties, or bearing up against long-continued anxiety and perplexity of mind, will find that he has taken a reed into his hand which will break and bruise instead of support and steady him. Difficulties may be borne with and surmounted even when they seem insurmountable and interminable; but never if the false ally *drink* be called in to assist in the warfare. Well may one in such a position say, with the Trojan hero, "Timeo Danaos et dona ferentes."

SECT. IV. DIET AND COOKERY.

Satisfied that the enunciation of principles is of more service towards the establishment of rules of Diet than minute individual directions, I have, at some length, endeavoured to show the general operation of nutrient substances upon the system; the manner in which they are dealt with by the digestive organs; and the best means of making these two factors agree together to the production of a healthy nutrition of the body. If these principles be borne

in mind, they will form the basis of a system of diet for every individual (so far as his means will allow of his obtaining the proper materials), and enable him to select his food and drink in accordance with the external circumstances in which he may be placed—as to occupation, temperature, &c.,—and to the internal conditions—such as temperament, habit, age, &c.—which equally modify the operation of the nutritive powers.

By careful observation of the action of different kinds of food and drink upon the system, and of its modification by frequency, time of meals, &c., to suit the individual temperament, each person should be able to regulate his own diet and that of his family. He is assisted in this by a knowledge of the different degrees of nutrient property in the several kinds of food, and also by that instinctive feeling which tells him whether he is exceeding or falling short of the proper quantity which his condition requires. This section will, therefore be devoted to some details as to the quantity and *proper time of taking food, the frequency and nature of meals*, and the kind of food best suited to different ages, &c.

What constitutes a *sufficient* diet? And how do so many persons remain in equally good health under the utmost diversity as to quantity, quality, and time of taking food? These two questions lie at the root of all systems of diet. They cannot be answered empirically, nor predicated for one person from the experience of another. For whilst the child of the wealthy citizen becomes pallid and wastes away under a diet of the most nutritive substances—meat, eggs, butter, &c.—the child of the agricultural labourer grows ruddy and plump upon little else than bread and potatoes. So, some people do very well with two meals a day, or even one good one, and another very light; others must have three, four, or even five

meals, in the twenty-four hours. All this shows that more than the digestive organs are concerned in dealing with diet, and that the demands of the system at large upon the duties of those organs must regulate the supplies submitted to their operation. There is but one rule as to quantity; and that is that, nutritive value being equal, the *supplies must equal the waste:* never much exceed, nor, if possible to avoid it, be allowed to fall the least short of it. Waste depends upon activity of function. Some persons, in performing similar amounts of labour, destroy more of their tissues than others; their bodily waste is greater, and they must have a greater bulk of food. If their digestive organs will not stand the strain, then nothing remains but to reduce the waste by lessening the quantity of work. If this truth were but well understood and acted upon, there would be very much less indigestion, nervous and muscular debility, and premature old age, than now unfortunately exists amongst those most actively engaged in "the battle of life."

There are other individuals whose privilege it is, either to convert their food into their own substance in a more complete manner than others, or else, which is more probable, whose greater nervous energy enables them to obtain larger results from a smaller amount of material. These persons seem to work well, and to show no symptoms of flagging under a comparatively small or innutritious diet, or with digestive powers of a feeble character; and it is they who appear to derive the most benefit from a moderate quantity of either infused or alcoholic drinks—tea, coffee, wine, or beer.

The persons here indicated are composed chiefly of *brain-workers;* and the assistance which they appear to derive from stimulating beverages may be accounted for by the acknowledged action of these fluids in reducing the quantity of solid food necessary to a given amount of work. Their action, in this case, is all the

more valuable, inasmuch as intellectual labour weakens the digestive powers of the stomach by withdrawing from it the proper afflux of blood necessary to the secretion of gastric juice in good quantity. This explanation of the value of alcoholic beverages where the wear and tear of mind is great, avoids the assumption, at present quite unsupported by any proof, that alcohol is a true nutriment to the brain and nervous system, and explains why many small eaters are able, with its moderate use, to go through an amount of brain-work to which the small quantity of their solid food seems entirely inadequate.

After all, the force of will, the capacity for exertion possessed by the mind, and, in a less degree, by the body also, does not depend upon the absolute quantity, or relative quantity as to work, of food taken into the body. There doubtless exist indefinite, perhaps for ever indefinable, properties of mind and body, varying in every individual, constituting talent, genius, and muscular energy, and which are independent of any known variation in the organization of the animal frame.

Notwithstanding these essentially varying circumstances, and the uncertainty which they must cast over every attempt to fix upon any precisely correct dietaries for any class of people, some uniformity is evidently required by the exigencies of family and social arrangements, and particularly for those who are fed under the management of others, as soldiers, prisoners, paupers, and the inmates of hospitals and asylums.*

Quantity of Food.—The quantity of food which

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* Dr. Brinton very properly observes that the existence of some waste in these institutions must not be taken as a proof of a superfluous diet, since some of the inmates, from various motives or habits of body, will waste their food, or take less than they require ; whilst the constant complete consumption of the regular allowance by the others may be no evidence that the diet is sufficient.—"On Food, and its Digestion."

a grown-up person requires to maintain himself in health and strength for work, has been computed at about thirty-two ounces of solids, and from two to four pints of drink, daily. This is the result of extensive observation of persons whose diet, as well as their amount of bodily waste and exertion, came under the inspection of competent observers. For persons who pass much of their time in inactivity, and for females generally, a much smaller quantity is consistent with health. People of the sanguine temperament eat and require more than those of the bilious or nervous; and, generally speaking, those on the near side of forty-five more than those who have "turned the corner" of life.*

But the quantity of food will vary according to its nutritive properties. Thus, where animal food can be procured in good quantity, it will reduce, and where farinaceous substances must compose the principal portion of the diet, they will increase, the absolute weight of food required.

Eight ounces of cooked meat, free from bone, may be taken as the maximum of daily food in that direction: many persons do well upon six, or four, or even less; but in their cases, a large allowance of bread seems absolutely necessary. Nothing will compensate for the abstraction of this latter, the primordial food of man, from the dietary; and it is as well to say that it appears to be much more necessary to affirm that from 12 to 16 oz. of the whole diet should consist of good bread, than to apportion the quantity of any other of the usual articles of food.

A due allowance of vegetables, by which is not meant potatoes or rice, which some people substitute (very wrongly) for vegetables properly so-called, is essential to a wholesome diet. Only a very few

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* Brinton, "Food, and its Digestion," 1861.

persons, if their digestive organs have not been weaned from the use of these articles by the substitution just named, are to be found to whom they prove hurtful. Besides the absolute nutriment which is contained in such roots as carrots, turnips, and parsnips, and in cabbage, cauliflower, peas, beans, salad, &c., they all contain some principles of a savoury character, and saline substances, which are greedily taken up by the blood, to enable it to perform those complicated operations of vital chemistry by which the various tissues are elaborated. The allowance of vegetables must not only supplement the meat and bread in making up the thirty-two ounces of absolute quantity, but if those vegetables consist chiefly of water,—as cabbage, turnips, salad, &c.—either they must be largely increased, which will not always agree with the digestive organs, or else such farinaceous things as potatoes, rice, puddings, &c., must be added. It may surprise many to see these last-named articles reduced to so mean a position in the scale of diet, constituting, as they do, almost the sole nutriment of large numbers of people; but such is their real physiological status. A gallon of potatoes will be required to substitute a pound of bread, and more than half as much of rice. Even then they are deficient in many of the qualities which give to wheaten bread, or to the meal of oats or peas, their great nutritive value; and they ought never to supplant these (as they unfortunately have done, not only in Ireland, but amongst our own poor) from forming the mainstay of life. The tables of both poor and rich, if potatoes are used, should never be without two vegetables, one of them being composed of roots, or leaves, or seedpods of the common garden plants.

To trace out the physiological, or rather pathological, effects of deficiency of food, would require us to enumerate half of the diseases which flesh is *not*

heir, but *succeeds* to; all sorts of defects in structure too would have to be enumerated; and not a little of deficient intellect and abnormal moral emotions. Our limits will not allow of anything more on this head than the giving of *one caution*—viz., not to take it for granted that because a diet, stinted either by ignorance, asceticism, or weak digestive powers, produces no *immediately* sensible bad effects, such as wasting or debility, that it is therefore *innoeuous*. It may, and indeed almost certainly will, either lay the seeds of future degenerative disease, or, what is far more commonly the case, light up and stir into activity the dormant germs of inherited disease, which, under a judicious and generous diet, might have withered in the bud, and eventually dropped out of the organism altogether.

Diet as modified by Age.—Children and aged people, presenting in their opposition so many real analogies, in the matter of diet possess many points of resemblance, and others altogether diverse. In children the peculiarity of nutrition is this: they have to take into their frames a larger amount of substance than they lose; at the same time the smallness of their organic development has to be considered. Their tissue waste is small, whilst growth is large. It is necessary, therefore, to watch the rapidity of growth, which is best done by occasionally carefully weighing them. The amount of development of the intellectual organs too must be taken notice of. Wherever great activity is, in youth, there the supply of food ought to be liberal. Children will not readily eat too much if they are kept to regular hours for meals, and made to eat slowly. The food of children should possess two qualities: it should be plain, yet easily converted into nourishment. Although they are building up the body apace, the digestive powers of the stomach have not yet reached their full development, and conse-

quently those substances which approach the nearest to the human frame in composition, should form the main portion of their food. Milk, eggs, and a moderate allowance of flesh-meat, are good. The vegetable food should principally consist of bread, with a small allowance of other starchy matters. Sugar, and especially butter, are to be allowed in *full quantity*. As few young children can digest the fat of meat easily, the sugar and butter are of prime importance in furnishing material for keeping up the heat of the body.

The *frequency* of meals for children under four years of age, should be about every three hours in the day, and for those between that age and fifteen or sixteen, at about every four hours, or four meals a day; and each of them should contain nearly the same bulk of solid food. Three of these meals may be composed of farinaceous materials, with butter, and the other of meat and vegetables. The miserable *bread-and-scrape* of schools of the Dotheboys' Hall character, had much to answer for in depriving the children of an essential principle (oil) of the diet, and one without which farinaceous substances lose half their value.

Old people resemble children in the feebleness of their digestive organs, and the same rules as to frequency of meals and choice of food are applicable in either case. Only, in the case of old people, the stomach, which has lost its edge by life-long wear and tear, requires a more stimulating diet, or rather the addition of stimulating condiments and drinks to rouse its dormant energies. Thus, they may take pepper and salt in milk, instead of sugar; pepper to rice; curries and sauces, to give relish to the plainer food which they should use.

Whoever has read that delightful old gossiping Venetian, Lewis Cornaro, who, in the amusing

egotism with which he relates his experiences, almost rivals those charming gossips Montaigne and Sir Thomas Browne, will find the principles of a diminished quantity of food, as age increases, insisted upon with great emphasis. The only exception to this rule is where great bodily or mental exertion is carried on far into old age—a fashion much more prevalent in this generation than formerly. There is certainly much to be said against putting a sudden termination to the activity of a life by the old-fashioned plan of making a fortune and retiring upon it, both in a moral point of view, and as regards health. But now that extended education has placed within the reach of all the more comfortable classes a variety of useful occupations suitable to the declining powers of life, at the same time that they are removed from the harass and toil which belong to those of middle age, the more natural system of reducing the supplies as labour is remitted ought to be again insisted upon.

The feebleness of the digestive powers in old people points to the necessity of saving them all the effort which can be done, by comminuting the food into small particles; by stewing, and otherwise reducing animal food into a pulpy mass, of which the "bouillon" and "bouillie" of the French furnish a good example.

Time and Frequency of Meals.—The time at which meals should be taken will be found to be regulated firstly by the period of sleep; and secondly by the time which is required for the complete digestion of the food previously taken into the stomach.

Breakfast.—On awaking from sleep, all the nutritive functions are in a debilitated and somewhat exhausted state, consequent upon the length of time which has elapsed since food was taken. To *break the fast* is, therefore, the first thing to be done. Physiology must dictate the nature of this meal.

The system is exhausted: it wants food. The stomach is weak, and should therefore be supplied sparingly with a gently stimulating, rather than with too much solid food. This, and the loss of fluid through the skin during the night, calls for a considerable allowance of liquid. Hence it is that coffee, as being more stimulating than tea, and, as containing a larger quantity of milk and sugar, affording a more nourishing beverage, has long been the favourite morning drink with robust people.

Weakly persons find benefit in taking a cup of tea on first awaking, or on beginning to dress. This is good practice. The gentle stimulus thus afforded to the nerves of the stomach by the warmth and aroma of the tea, vivifies the system, and in a little time enables a person to digest a very fair breakfast, for which had he (generally it is she) deferred taking food until the labour of dressing should have been undergone, appetite would have completely failed.

Opposed to this is the case of the very robust, who, by using more or less exercise in the open air before breakfast, are able to take as much food at that meal as at any other during the day.

The stomach must not be overloaded at breakfast. It is a common mistake to suppose that any unusual exertion about to be undertaken—as travelling, for instance—requires the system to be fortified with a heavy breakfast. The meal then taken is *not* the one which can give strength for the work of the morning, and any excess beyond the usual quantity is apt to result in oppression of the stomach and dulness for the whole day afterwards. The stomach, weak on first rising, acquires vigour as the day proceeds; and at two o'clock, and again at five or six, is perhaps possessed of its fullest powers.

A small quantity of animal food, meat or eggs, is suitable for breakfast; as are also potted and pre-

served meats, broiled fish, &c., as these, by their flavour, excite the flow of gastric juice. Cold meat has the disadvantage of not possessing the stimulating properties which hot meat derives from the osmazome and volatile principles; and for this reason too large a quantity is apt to be eaten before the stomach seems to take notice of its presence.

Other Meals.—The meals which follow breakfast—viz., luncheon, early dinner, tea, late dinner, supper—will take their character from it, and from the amount of wear and tear of muscle or mind which has to be undergone during the day.

Such variety, and indeed confusion, has of late years been introduced into the time and manner of taking meals, that the names by which they are called are no longer any indication of their position with reference to the time of day. When Queen Elizabeth breakfasted before daylight, dined at eleven a.m., and supped at five or six, the time of day indicated the nature of the meal. Now, although some food is still taken at nearly the same periods of the day as formerly, the names of the meals range between *déjeûner à la fourchette*, luncheon, dinner, tea, and supper, in a manner only explicable by a reference to the social status of the recipient.

Classification of them.—The only philosophical way of arranging meals as to time of day, so as to avoid the *bêtise* of miscalling the fashionable lady's substantial two-o'clock meal, *dinner*, and her light and elegant repast at eight, supper, is to classify them into two or three orders. We may, I think, take it for granted, looking at the customs of almost all nations, ancient and modern, and of the great majority of persons amongst ourselves, that the natural number of meals in the day is three—the morning, noon-day, and evening meals. It is by

ringing the changes upon these, by dividing, or condensing them to suit the exigencies of pleasure or occupation, that all the variety of meals, as regards number and time, is brought about. The working man, whose constant expenditure of strength requires as constant replenishing, always takes substantial food three times a day. If he reduces the number to two, either his strength fails, or his digestion becomes disordered in attempting to cope with the excessive bulk of the food, and the same effect ensues. On the other hand, he may, and generally does, add to these three natural meals another of a lighter character—tea, in accordance with the exigencies of modern custom.

In the arrangement of these *four* meals, which the peasant takes at pretty regular equal intervals, a number of changes are made by the more affluent portion of society. One plan is to make two chief and two subsidiary meals. A substantial breakfast is followed, four or five hours after, by a light luncheon, perhaps only a biscuit and glass of beer or wine; and dinner at five, six, or seven o'clock, is followed by tea and bread-and-butter at eight or nine. This is the plan pursued by thousands of men of business, professional men, and other brain-workers; and if the time of each meal be properly regulated, and exhaustion guarded against, it is perhaps the best arrangement, next to the natural one before described; and for those who have to employ their minds upon intricate matters soon after a meal, certainly *the* best.

Two things are necessary to secure this plan working well. The breakfast must be tolerably substantial and nourishing, otherwise the trifling luncheon will not suffice to stave off exhaustion until dinner-time. Secondly, the dinner must not be at too late an hour, otherwise the exercise which will be

found necessary to get an appetite, instead of exciting, will only exhaust the remaining powers of the body. If the breakfast be at nine, the dinner should be not later than five or six, with tea at eight.

Another arrangement makes three moderate and one heavy meal during the day. This is much practised by tradesmen and others, who take all their meals *en famille.* A moderate breakfast, a solid and substantial noon-day dinner, tea, with bread-and-butter, and a supper of bread-and-cheese, or cold meat. This plan suits the persons who practise it, whose labour is generally not severe, and the mental portion of it of a somewhat routine character. Those who live much in the open air follow nearly the same rules as to meals as the labourer before mentioned. They take three, or generally four, meals a day at about equal intervals, and all of them substantial. Thus every four hours the stomach receives as much food as it can digest, and that immediately it has finished the preceding meal. A perfect digestion is required for this practice ; and in order that it may remain so, the expenditure of material in bodily exercise must equal the supplies taken in, or repletion and disease will certainly ensue.

There is a modification of the second plan, which is now very prevalent amongst persons not much engaged in business, the higher classes, and especially in good country houses. It comprises a fair breakfast, varying very much in quantity according as it is taken in town or in the country; a substantial meat luncheon, with dinner of an elaborate, but not extremely heavy character, late in the evening; the meal of tea being reduced to the mere taking of a cup of tea or coffee either before dinner, after, or both.

The danger of this plan of dieting arises from repletion. Two full and highly nutritious meals are

taken in the day, and to get rid of such an amount of stimulating material, much bodily exercise will be required. The sportsman, the college student, *reading* as he takes his vacation ramble, hard-working youths generally, and indeed, all who are much out of doors and possessed of good digestive powers, may use this plan with safety. But the dyspeptic, persons of studious and inert habits, and ladies generally, should be cautious how they make *two dinners* (for it comes to that) in the twenty-four hours. The evil is increased, if, *in the season*, the exigencies of modern society, with its late hours and crowded rooms, by again exhausting the system after dinner, require another meal, in the shape of supper, which, though called *light*, consists of nutriment in the most concentrated shape.

A fourth plan, much followed by the mercantile classes who live out of town, professional men, and others, is to make three of the four meals *very light*, the other, dinner, being heavy and substantial. The breakfast consists of little more than tea and toast, the luncheon of a biscuit and glass of beer or wine, or a small bowl of soup, and tea is reduced to one or two cups, without eating. Dinner is, to such persons, the one grand dietetic event of the day. Several courses, and great variety, are here the order; and the stomach is expected to deal with soup, fish, meat, pastry, fruit, beer, and wine, followed by coffee, as if it had reserved all its powers for this grand encounter. How it struggles to do its duty to the best of its ability, I have already detailed. Failure, however, is the rule; and such persons are repaid for a day of activity and turmoil, by somnolence, languor, and discomfort for the whole evening.

There is a great mistake committed here; and the mistake arises from ignorance, or wilful disregard of the function of digestion. There is no accumulation

of digestive energy laid up in the stomach by long fasting. The system, indeed, craves for food, but the powers of the stomach are wasted by not having been called forth at proper intervals during the day. The body, too, is wearied from the want of proper supplies, and everything makes against the hope of digesting, late at night, the heaviest meal of the day. It is from amongst the numerous devotees of this vicious system of diet, that the ranks of dyspeptics and hypochondriacs, the clients of homœopaths, hydropaths, and every other forlorn hope of the healing art, are drawn.

There are two results which flow from long continuance of this system of diet, each of a very different character, both equally destructive to health and usefulness. The one is, that the individual who indulges in the rich dishes and superfluous albuminous food to the degree of excess which the previous too spare diet during the day induces, at night, if his digestion be vigorous, throws into his system a much greater quantity of material than its rate of nutrition can dispose of; consequently, such an one soon suffers from repletion; the vessels are surcharged with rich matter, which oppresses and stupifies the brain, and the abundance of fat which is received into the blood is deposited in the substance of the organs, disintegrating the muscle, and, above all, damaging the integrity of the heart and great vessels. The fate of such people is too often that described by an Hibernian; viz., "to go to sleep after dinner, and *awake* in an apoplectic fit."

The other result is that which has already been described in speaking of digestion generally. The stomach, habitually overloaded with nutritive matter, becomes irritated and sullen, and refuses to pour out gastric juice in sufficient quantity to fully chymify the mass of food. By consequence, the food passes

into the intestine only half digested, undergoes there putrefactive changes, which make themselves known to the victim of this system by painful digestion, irritable bowels, foul tongue, loss of rest, and a dry and feverish skin. These persons do not suffer, as those just described do, from an accumulation of fat in the system. Far otherwise. They are starved in the midst of plenty; the organs are not properly nourished; receiving only a crude and ill-elaborated blood, which tends to produce degenerative disease, from which recovery is not to be expected.

Still it may be asked, Which of these plans is the best for me to follow? This is a question, good reader, which you are now expected to answer for yourself. No one knows so well as you what are the peculiarities of your constitution; what your occupation and circumstances in life. You have got certain general principles to go upon; from these deduce your own particular regimen.

First: You know that digestion, with most people, takes from three to five hours for completion; and that, although the contrary has been stated, it should *not* be interfered with by taking fresh substance into the stomach whilst that organ is engaged with a former meal. *Secondly:* Like all other organs, the stomach requires that rest should follow active exertion; a short time, therefore, should elapse between the complete emptying of the stomach and refilling it. This is not to say that food may not, in some cases, be again taken before the absorption of the last meal has been completed in the small intestines. In many persons, the passage of the food through the stomach—the first part of digestion—is very rapid, and a feeling of want arises in three or four hours after every meal. *Thirdly:* Take notice whether your digestion be slow or quick; if the former, place a considerable period between your meals (these are

the cases where two meals a day suit very well); say seven or eight hours; if it be quick, and perhaps imperfect, food must be taken in moderate quantity every four hours. *Fourthly*, and lastly: Remember that the digestion (of town's people at least) is weakest in the morning, improves as the day proceeds, but after long and exhausting labour, becomes again feeble. The best meal of the day, therefore, should range between two and six o'clock.

It matters not at which meal—at one only, or at several—animal food be taken, provided the proper quantity requisite for the whole day be not exceeded; but, as a rule, the greater part of it should be taken when the digestion is most vigorous. Delicate people, and those who exhaust the nervous force by brain-work in the evening, should always take a little supper to prevent their passing restless nights from exhaustion. A little arrowroot, with a tablespoonful of brandy, or a cup of chocolate with bread and butter, answers this end very well.

Of wine and beer, with reference to their different kinds as a part of dietetics, it is not my purpose to speak. No general rules can be given applicable to large numbers of persons. It is probable that a frequent change of drink will be found more beneficial than adhering to one kind of beverage upon all occasions.

No kind of alcoholic stimulant is requisite, or even safe, before the noon-day meal. The only departure from this should be under medical supervision; and, generally speaking, their use should be restricted to the two chief meals of the day. With the exception of a glass of sherry to whip the stomach into life before taking food, after exhausting labour, wine and beer should accompany and mix with the food, very little being taken after the meal is over. If, however, after-dinner drinking must be practised, the wine should be of the lighter kinds—Claret, or good Madeira—or

at least such as will not excite fermentation in the mass of food by the unconverted sugar they contain. What are called dry wines are here indicated.

Tea and Coffee after Dinner.—The manner of taking tea and coffee after *very late dinners* requires a passing notice. If physiology can decide anything in regard to food, it tells us plainly enough that taking strong tea or coffee after a full meal is about the worst thing we can do. Their effects are to delay digestion when the stomach is full, but to postpone or mitigate the feeling of exhaustion when it is empty. Much of the fulness felt at the pit of the stomach after dinner, in society, is caused by the liberation of gases by an arrest of the process of digestion consequent upon taking strong coffee too soon after a full meal. The wine alone tends sufficiently to disturb, and therefore to retard digestion, when more than a very moderate quantity has been taken; and if to this be added the further check caused by either strong tea or coffee, indigestion, restless nights, and absence of appetite for breakfast, are pretty certain to result.

The modern practice in good society of taking tea between luncheon and late dinner (the kettledrum) is a good one, as it follows the first at a sufficient distance to secure its stimulating and refreshing operation without injury to digestion; and, by preceding the latter, defers any feeling of exhaustion by supplying the place of food. In reality, it here comes in at the good old-fashioned time—viz., between dinner and supper. *After late dinners* a cup of *weak* tea may be taken, or a glass of cold water on going to bed will be unexceptionable. Ices, when eaten slowly, seem to be perfectly harmless.

Quality of Food.—We must not omit to say one word upon the quality of the food, vegetable and animal, submitted to digestion.

It is probable that too much stress has been laid

upon differences existing between the several kinds of animal food, and that the general preference given to one or two has often led to the exclusion of all the rest from the diet, especially in the case of invalids. Who has not heard an habitual dyspeptic say, "I live upon mutton?" and yet he remains dyspeptic. The "toujours perdrix" is as jading to the stomach as it is deadening to the appetite. The instinct for variety is founded upon laws of the economy which govern the whole act of digestion. By variety, the nerves of the stomach are excited; they solicit to the organ a greater supply of blood. All organs get accustomed to uniformity of stimulus, and their functions are then not fully called into action. Besides, there is danger of preferring an inferior quality of food which it is the fashion to eulogize, to the best kinds of some less favourite subjects. Tough mutton is a great deal worse for a weak stomach than young tender beef; and the flesh of an *old* chicken (they are always *chickens*) may be infinitely less grateful to one with weak digestion than that of the much-disparaged porker.

All food should be taken "au naturel." The greatest feats of cooking may be bestowed upon it, but its component parts must not be separated from each other and exhibited alone. Thus, jelly taken by itself is worthless, probably entirely devoid of nutritive qualities, since dogs fed exclusively upon it died in as short a time as others which were kept entirely without food. Thus, also, our roast joint, although a somewhat extravagant dish, is the perfection of food, because all the natural elements are closed up in it. The jelly, the fat, the extractive and saline particles, are all there, and are all of use in the organism. When meat is boiled, the liquor should always be concentrated and served as soup, or as gravy to the meat. The French "bouilli," without the

"bouillon" belonging to it, would be almost useless as nourishment.

But whilst all the ingredients of our compound food should be exhibited together in the connexion which nature has given to them, the means which modern science takes to improve the *quality* of food are of the highest value. Although we lose the fine flavour which helps to render six or eight-year-old mutton so digestible when well kept, in regard to the meat now supplied to our tables, the perfection of feeding is such as to make the flesh of young animals as digestible as that of old. The deposition of fat between the muscular fibres of these young animals renders their separation in the stomach much easier than is the case with older meat. The more complete fattening, too, of semi-wild animals—park-deer, pheasants, &c.—improves the digestibility of their flesh.

The products of our gardens and orchards are equally ameliorated by scientific culture with those of the field and fold. In fact, the increase of the albuminous and saccharine principles of our vegetables and fruits, at the expense of the indigestible woody fibre, is one of the greatest achievements of modern horticulture.

CHAPTER VI.

EXERCISE.

Origin of the term—Nature and objects—Effects of exercise upon the animal functions—Upon the circulation and respiration—Upon animal heat—Secretion of the lungs—Skin—Exercise of children and youth—Of young girls—Necessity for shortening the period of lessons—Exercise of both sides of the body alike—Danger of violent exercise to delicate children—Exercise of adults—Exercise for the purpose of maintaining health a modern idea—Salubrity of different kinds of labour—Exercise proportioned to the vital powers—Time of day when exercise is best taken—Exercise as regards temperament, age, season, &c.—Bathing—Sleep.

If we take the term exercise to be derived from the Latin word *exeo*, to go out, to spring forth, to grow up, we shall form no inadequate idea of its nature and objects. As its root implies, exercise is of an essentially active character; for although we speak of active and passive exercises, by the latter term is clearly meant the *act of being exercised, or carried*, gestation by the exertions of some other person or thing. We speak also of mental exercise as an action or motion of the mind. The Romans could invent no better word by which to express what we call an army than "*exercitus*," a word derived from the same root as exercise; the evolutions and manual exercises of soldiers forming a most important part of their operations. This, the original meaning of the term, seems to have degenerated afterwards into expressing the mere performance of a man's own handicraft or

calling; and the mental division of exercise had the same meaning, as when religious persons were said to exercise themselves in prayer and contemplation. Our modern idea of exercise is derived from the present culmination of this result of civilization, viz., the confinement of large numbers of people within doors during the greater part of the day, and the consequent want that is felt of some change of muscular motion as an essential to health of both body and mind. The idea of the pursuit of health has therefore come to be imported into the concrete notion of exercise.

Nature, Objects, and Effects of Exercise.—Such being our present notion of the nature and ultimate intention of exercise, we can now ask ourselves, What are its proximate or immediate objects? and upon what physiological facts do they depend for their claims upon our acquiescence in their importance? Look at that sleeping dog lying outstretched upon the grass in the sun. Can anything better express pure inactivity and repose? Not a hair moves. Scarcely does a breath leave his nostrils. Yet, within that animal microcosm all is activity and life. Rouse him, and set him upon the track of the springing hare, and, whilst flying over the ground with race-horse speed, every atom of sinew, of muscle, of nerve, is called into incessant motion; every drop of blood is coursing through his veins at a rate not exceeded by that at which he pursues his prey, and, speedier than all, is the electric current which, flying every instant from his excited brain, stimulates each nerve to animate the muscles to their work.

The final cause, or necessity of exercise, then, arises from the fact that the delicate machinery of the human frame requires a stimulus *external to the body itself* to keep it in healthy action; just as the finest and most self-acting machines which man's

ingenuity can invent, require to be kept in motion to prevent rust and injury. Activity is, in either case, the measure of perfection; and the nice adjustment of the stimulating or moving power to the condition of the machine, whether mechanical or vital, is the one thing which exhibits the skill both of the mechanician and of the physiologist. The thought here arises, What if the mechanist does not understand his task? What if he is ignorant of the just balance of force to be applied, and the true modicum of action to be obtained? Soon will be disordered all this delicate structure; and the more delicate and the more refined its make, the more sensitive its temperament, the greater will be the danger of ignorant or reckless exercise proving destructive to its usefulness and fatal to the perfection of its mechanism. There is danger of injury; there is danger also of wearing out. And before leaving the subject, I shall have to record words of caution as to *abuse*, quite as emphatic as those I am about to say on the *uses*, of exercise. For whilst it is true that inaction corrodes and rusts the lifeless machinery of the artizan, and corrupts and devitalizes the far more delicate organs of the human body, so also it is true that whilst overdriving may discompose or fracture the machine, yet, in most cases, repair may be possible, and a useful, though imperfect one remain. If the human mechanism be stretched too far, if the forces of body and mind be prematurely exhausted by over-exertion, nothing remains but a wreck, a living death of the one, and a total overthrow and annihilation of the other.

Effects of Exercise upon the Animal Functions.— Whilst thus remarking upon the general effects of exercise upon the mechanism of the body as a whole, we are naturally led to inquire into the mode by which motion of the limbs, walking, riding, &c.,

operate upon the several functions of circulation, respiration, and secretion. We know that the circulation of the blood is able to maintain itself by the sole force of the heart's action, assisted by the pressure caused by the tonic contraction of the vessels themselves upon the column of blood within them. But, except in very vigorous and young subjects, the circulation, thus left unaided, is apt to become enfeebled, and to stagnate in dependent parts of the body, especially if the upright position has to be maintained for a very large portion of the day.

Upon the Circulation.—Now the return of blood to the heart by the veins, the rapidity of which is the measure of the goodness of the circulation, is very much assisted by *pressure*, and especially by that equable and universal pressure which is caused by muscular action. The veins are composed of thinner and less elastic material than the arteries, and they are possessed of less tonic contractility; they are consequently very apt to dilate, and by so doing, in accordance with the well-known laws of hydraulics, the velocity of the current in them is diminished. This, however, is not the only evil which arises from dilatation of the veins. The valves, with which they are plentifully supplied to prevent the retrograde motion of the blood, become deficient, and thus there is required a greater power behind—*vis à tergo*—to force forward the current of blood. This *vis à tergo* can only be derived from the heart; and thus the powers of this organ are taxed to an undue degree whenever the venous system becomes defective. Various means are in use to ward off or diminish the evil effects which ensue when this state of things has arrived. The recumbent position will relieve the vessels from a part of the pressure of the superincumbent column of blood; and, in the case of dilated veins of the lower extremities, will be of great

service. Continual pressure, by means of laced stockings, and elastic bandages and belts, will, to some extent, render recumbence less necessary, or at least assist its operation.

Supposing the neglect of proper exercise to have been carried to a great extent, and the venous system to have become permanently weakened and dilated, fresh and more serious results ensue. The continued call upon the heart's energies for extra force to remove the stagnant blood in the smaller veins, at length tires it out; the muscular substance of its walls becomes weakened, and the cavities extend at the expense of the thickness of their walls. What is called passive dilatation of the heart is now induced, and all the evils of a sluggish circulation are deepened and made permanent. A dilated heart is unable long to contend against the vis inertiæ of the weight of fluids it is called upon to move, and more and more dilatation of the extreme vessels takes place. A condition now arrives in which the weakened and distended veins seek relief by discharging some of their contents into the surrounding structures by pouring out the fluid parts of the blood through their walls, or even by rupture of them. This condition is termed dropsy; and whether it takes place in some of the great cavities, as the chest and abdomen, or in the cellular tissue of the limbs, or beneath the skin throughout the whole surface of the body, it is of the same nature, and results from the same cause.

The primary object of exercise, therefore, and indeed, that which embraces all others, is *to maintain the circulation in a normal state, both as to rapidity and force.* When this is accomplished, all the other good results which we attribute to exercise will in every instance follow.

This perhaps somewhat tedious description of the physiology of exercise as it affects the circulation of

the blood, seemed to the author to be desirable on two grounds. Educated persons must have often enough read the usual exhortations to exercise which are based upon the empirical observation of its general results. But in these days, rules must be logically deduced from well-ascertained facts, to be accepted by the more reflective portion of the community. Secondly, the plain statement of the sad results of inattention to Nature's teaching may have the effect of exciting the fears of the idle and sluggish, or even of those who are too busy making money to attend to the demands of the system, so as to lead to improved habits and a more healthy tone of mind. If the author claims for this little work any merit at all, it is chiefly as an exponent of the known laws of physiology in their application to the daily wants and the daily duties of life.

It is to be remarked that the necessity for exercise is here based upon grounds which have not necessarily any analogy in the rest of the animal kingdom, taken generally. It is the peculiarities of our structure and of the circulation in particular, taken with reference to the *erect position*, upon which the necessity and the value of exercise depend. Numerous other suggestions will present themselves to the mind when reflecting upon these facts; amongst which will be perceived the moral bearing of that ordinance by which Nature has imposed upon us this additional trouble in the care of our health. The social intercourse, the emulation and rivalry, the contempt of danger, and the presence of mind in emergencies engendered by active exercise, draw much of their value and importance, as means of man's moral and physical amelioration, from this necessity of his nature.

Effects upon the Circulation in different Classes of People.—The physiological effects of exercise may be more particularly illustrated by an instance or two

of its operation in the cases of persons of different occupations and pursuits. A gentleman employed in a public office or bank, a police-magistrate who passes many hours of each day on the Bench, the editor at his desk, or any other person whose occupation is sedentary and inactive as regards the body, whilst the intellect is kept in continual activity, requires that the brain should be supported by an afflux of blood to it in due force and velocity; without which the power of judging will fail, and the attention necessary for continuous thought will flag. Except in persons of very strong powers, this derivation of the blood to the brain and nervous centres, withdraws it, in some measure, from other parts of the body. Not only do the extremities become cold and numb, but the internal organs suffer from loss of their fair share of blood. From this cause the appetite and digestion fail, although a craving for support may be felt. Towards the close of the day's work, the brain becomes exhausted from over-stimulation, and the blood begins to stagnate there also. The brain-substance ceases to be renewed, and now mental as well as bodily exhaustion supervenes. At the usual hour, he rises from his desk and walks homewards, or else takes a ride in the Park, or is driven some distance to his suburban villa. In the first two cases, if the exercise be not extreme, the headache or exhaustion which oppressed him when he left his office is removed, and by the time he arrives at home and sits down to dinner, he has acquired sufficient appetite and power to digest his food, and again to engage in lighter mental occupation in the evening without injury. How does this come about? Simply by *changing* the current of the circulation. The blood, which during the long inaction of the body, stagnated in its lower parts, whilst it coursed too rapidly through the head, by active exercise and the pressure of the

muscles upon the veins, is forced onwards towards the heart, stimulating that organ to more rapid contraction in order to pass the blood through it. The venous system being thus assisted in propelling onwards the blood, makes less demands upon the heart's force, and thus the rapidity of the circulation is increased whilst the heart is less embarrassed. So long as this organ remains sound, and the nervous energy is unexhausted, these good effects will be certain to follow from active exercise taken in due quantity and at the proper time.

Having given precedence to the mental worker, suppose we now take the case of the tailor or shoemaker, or even the poor dress-maker, whose several labours compel them to assume some constrained position of the body, with unequal exertion of their muscles. The arms and hands, as well as the muscles of the back, and of the eyes, are here unduly taxed; whilst the muscles of the legs suffer from diminished flow of blood towards them. The poor milliner's feet swell; the legs of the tailor waste from disuse; and the shoemaker suffers from aggravated dyspepsia, the result of pressure upon the chest and stomach. Now the interposition of an hour's walk, once or twice in the day, would remove all these ailments, by equalizing the circulation in the limbs and removing congestion of the internal organs.

Again: A person may have experienced a long fit of illness, which has necessitated his remaining inert for a considerable time. He may have suffered an inflammation or congestion of some internal vital organ, as the lung, liver, or kidney. The means requisite to subdue these may have temporarily debilitated the system, whilst the disease has weakened the local vessels. The more acute symptoms having been removed, there remains the general and local

debility, threatening the incidence of some chronic mischief. How does the physician set about the removal of this state of affairs? The patient is probably incapable of any active exertion. If a part has been inflamed or congested, he orders frictions and bandages to support the weakened vessels. If some internal organ has been affected, he rubs into the skin over the part stimulating liniments for the purpose of exciting the neighbouring vessels, and orders bathing and friction to the whole surface. Having in this way relieved the heart and strengthened the vessels, he now directs the patient to take drives and short walks, to excite still further the powers of the circulation. In all these cases excitation of the circulation is the immediate physiological effect of the means used under the name of exercise, and all the other good results flow naturally from it.

Whether we be carried rapidly through the air on horseback or in a carriage, exciting thereby the respiration, or take a brisk walk, ascend a hill, or use gymnastic exercises, or play upon wind instruments, or bathe and rub the surface of the body until it becomes red and warm—in each of these cases the ultimate effect is the same, though obtained in various degrees. The blood is equably diffused throughout the whole body; the congestion of any weak part is relieved; the brain especially, being supplied with purer blood derived from the oxygen inhaled, acquires freer powers, the spirits become more elastic, the tone of mind more cheerful and hopeful, and courage, that peculiar compound of animal well-being and force of character, rises to its highest pitch. All these effects are derivable, and derivable only, from an equable and vigorous circulation of pure blood throughout every organ of the body.

Effects of Exercise upon Animal Heat.—Animal heat, although it is doubtless mainly dependent upon the supply of chemical food, that is to say, of food which, by union with oxygen gas, gives out a large quantity of heat, is also in part derived from the destruction of the tissues of the body by the oxygen absorbed from the blood for that purpose. Anything, therefore, which increases the absorption of oxygen by the lungs will produce a more rapid removal of the old, and deposit of new material, which together make up the very essence of animal life.

Doubtless there are great differences in the temperament and other qualities of different persons; and *rapidity* of action is not necessarily a test of strength or endurance. The slow-moving elephant cannot, without great violence to our ideas of what constitutes the whole sum of animal life, be considered to be less alive, to exhibit less exalted functions, than the sprightly monkey or the still more active members of the feathered race.

It appears to me that, whilst we run the risk of falling into many errors by comparing the vital activity of *different* animals together, we may safely compare the functions of an individual when in a state of undevelopment or inactivity, the result of defective or perverted use, with what they may become under well-regulated exercise. Here there is no question that an individual lives more completely at one period than another, according as he exercises, or not, his several vital powers. Nor must it be said that there is only a certain amount of vital activity accorded to any individual, and that by rest or careful exercise his powers may be husbanded and prolonged. The fallacy here implied arises from not distinguishing between what the bodily powers are capable of, the amount of innate force to be developed under proper and healthy

stimulation by exercise and replenishment by new substance, and the mere endurance of an inanimate machine, in which no renewal of substance can take place.

There is no action of the body, nor, probably, any of the mind, which is not accompanied with some loss of vitality in the organs exercised. Every step we take wears out—kills—some particles of the muscles of our legs. Every thought we think wastes, in like manner, some portion of the brain's substance. This being so, the greater the demand upon either the muscular or mental powers, the greater the amount of exercise which will be needed to enable the heart to send an increased flow of blood to that part of the body upon which we are drawing for our exertions, without injury to other organs. In the healthy body exercise will engender corresponding appetite and digestion, and thereby the loss of substance will be repaired. Air, Exercise, and Food, seem to be, in this sense, convertible terms, or rather correlative forces. Muscular movement, by exciting the heart and quickening the respiration, causes the admixture of a greater quantity of oxygen with the blood, by which the secretions and excretions are augmented, and more food assimilated and converted into muscular and mental force. Hence arises a due supply of animal heat to keep the fluids in a sufficiently active state, and to resist the benumbing and destructive effects of cold. The man who generates the most animal heat is generally in the highest state of health, and that temperament which presents this function in its highest activity may be said to possess the highest degree of vitality; *to live* more completely than others whose activity in this respect is lower. The sanguine temperament, or a mixture of that with the nervous, presents these qualities in the highest degree; and, as persons of

these temperaments possess a stronger circulation than others, so they feel cold less, and require a smaller amount of clothing.

The Influence of Exercise upon the Secretions.—The brief description given above of the effects of exercise upon the bodily functions includes only one of them—viz., the circulation, and its dependent animal heat. The beneficial effects of exercise upon the secretions, those outlets by which effete and worn-out matter is eliminated from the body, the blood purified, and the vital force of the brain and nervous system sustained, must now be adverted to.

The only normal and permanent stimulant to the secretions is *healthy blood*, and that can only be obtained by maintaining the force of the circulation by exercise, and supplying its waste by wholesome food.*

The largest emunctory or cleansing organs of the body are the lungs. Spread out into the most delicate network over a surface of many thousands of square inches, they are yet rolled up into the comparatively small compass which they occupy within the chest. From their whole surface is constantly being emitted carbonic acid gas, with watery vapour. This carbonic acid, if retained but for a few minutes in the

* What hosts of quackeries have been foisted upon the public under colour of this great truth! Medicines without number, cures by water, cures by magnetic traction, cures by mesmerism, water-cures, grape-cures, and movement-cures; the last, taken in proper manner and extent, being the only real cure of them all. For, after all, it is to muscular exercise that are really due nearly all the benefits derived from cold water and other specialties of the same kind. What would be the effect of bathing without the rubbing and walking exercise so earnestly enjoined to accompany its use? Unreflective people are always prone to grasp at the shadow instead of the substance, and to reason from the *post* hoc to the *propter* hoc. In the water-cure, however, as judiciously administered by those whose lives have been devoted to the study of its effects, the public get both shadow, substance, and marrow, when *bathing*, *friction*, *exercise*, and *judicious diet* are combined with freedom from business and care.

system, would prove fatal. How important, then, to keep the lungs in an active and healthy condition! If the evolution of carbonic acid by the lungs be even materially reduced by inaction or by breathing an impure air, its retention poisons the whole mass of blood, and soon embarrasses the operations of the brain, obscuring the intellect, and deadening the powers of sensation and perception.

Inaction is particularly detrimental to the function of the lungs. A person sitting at a desk, or standing all day behind a counter, scarcely breathes one-half of the amount of air which he ought to do. The pulse sinks to the lowest ebb, and the respirations are so gentle and superficial, that frequently not more than eight or ten, instead of twenty or thirty cubic inches of air are changed at each breath. No wonder that such persons feel towards the close of the day so much languor and lassitude and depression of spirits. If they are wise enough to take a brisk walk so soon as these feelings make their approach, say in the middle and again at the close of business, the mind will regain its tone and cheerfulness; and life, which an hour before seemed an intolerable burden, will now be filled with hope and cheerful enjoyment.

No exercise is of use which does not quicken the respiration (in the healthy), make the pulse fuller, and the skin sensibly warmer. The violence of the exercise must be in some measure apportioned to the length of time during which it can be taken, and to the powers of the constitution. A healthy person, who can only spare an hour or so for the purposes of this necessary operation, may use some of the severer kinds of exercise—such as running, quick walking, riding at a very brisk pace, the gymnastic apparatus, or the games of tennis or racket. Walking at a slower pace, billiards, archery, or bowling, will

be safer for debilitated constitutions and older people. Boating is a severe exercise when done against time, or in competition, and can then only safely be engaged in after proper and lengthened training. More than one Oxford and Cambridge prizeman has suffered for the remainder of his days, from the severity of the tax upon the heart's powers, which this crack exercise imposes.

Next to the lungs, the skin presents the largest excreting surface in the body. With 2500 square inches of surface, upon every part of which innumerable ducts open to discharge their peculiar secretion, it is necessarily supplied with a highly developed vascular system, which is capable of receiving very different allowances of blood. Under long-continued inaction, the surface of the skin becomes rough, hard, and inelastic. The pores become clogged with dried-up secretion, and the whole surface looks muddy and unwholesome. As a consequence of this state of the surface, the blood is thrown with increased force upon the internal organs of the body, and congestions, followed too often by organic disease, are the consequence.

Now the skin, merely as the covering of the body, might do very well without any particular attention being paid to its condition. But it is as one of the great organs by which the blood is relieved of deleterious animal matter, as well as excess of water, that the importance of its circulation comes into force. When the action of the skin is habitually checked by insufficient clothing, or oftener by deficient exercise, one or more of the internal organs are sure to be overloaded with blood, their vessels to become dilated, and their important functions thereby impeded. For a time, perhaps, the kidneys will do their best to remedy the defective action of their correlative organs, the sweat-glands. Whilst

they remain healthy, water, saline and animal matter in increased quantity will pass off through their vicarious assistance. A time comes, however, when they refuse to do both their own work and that of another organ, and serious disease soon sets in, which is not slow in propagating itself to the other vital parts. It is seldom that a person who has long habitually neglected proper exercise and the due cleansing of the skin, presents only *one* simple disease ; he is more generally the subject of a complication of disorders, all of them, however, linked and tied together by the operation of the same exciting cause. Retained animal matter, which should have been cast out of the system, becomes deposited in the lungs, the liver, or in the great vessels, and interferes with the action of every one of them.

The proper means of determining a normal amount of blood to the cutaneous surface so as to enable it to discharge a sufficient quantity of watery vapour and animal matter, is by *friction* after washing and bathing. This should be done on first rising in the morning, and then walking after breakfast will have the effect of continuing the determination of blood to the surface ; but this subject will be again adverted to under the head of bathing.

It is not unusual for people to imagine that the skin perspires only when there are sensible drops of fluid found on its surface. This is a great mistake. It is only when the fluid pours out of the sweat-pores in such quantity that the heat of the body is not sufficient to convert it into vapour as fast as it exudes, that it assumes the liquid form. There is always going on in the healthy skin an exhalation of vapour, insensible to the sight, carrying with it a certain small quantity of animal matter, which last, however, is generally caught and fixed in the meshes

of the underclothing through which the vapour is filtered. This, the insensible perspiration, is of infinitely more importance than the visible sweat; and it is by keeping up the heat of the body by exercise, and determining a due supply of blood to the vessels of the skin, that this great purifying function is maintained.

What, then, shall we say of people, who after all that has been said and written upon the subject, seldom or never even wash the whole surface of the body (to say nothing of bathing); who allow the pores of the skin to get blocked up with a combination of dust and perspired matter, which is as effectual in its way as plaster to the walls of a building? These are the *really dirty people*, who keep the effete and rapidly putrifying matter within their bodies to poison themselves with, and the exhalations from whom, in the concentrated form they must necessarily assume, we know to be nauseous and loathsome in the extreme. Could they but once be tempted to taste the delights which arise from a perfectly clean and well-acting skin; the cheerfulness, nay the feeling of moral as well as physical elevation, which accompanies the sense of that cleanliness, they would soon esteem the little time and trouble spent in the bath, and in the proper care of the surface of the body, as time and labour very well spent.

VALUE OF DIFFERENT KINDS OF EXERCISE IN REFERENCE TO AGE, SEX, HABIT, CLIMATE, AND SEASON.

I now proceed to estimate the relative value of different kinds of active exercise, as means of exciting the normal action of the circulatory and secreting apparatus, and their adaptability to the exigencies of the various ages, temperaments, and social circumstances of different classes and individuals. In order to do this, respect must be had to the peculiarities of

diet, season, climate, residence, and other conditions of the vital stimuli by which we are surrounded.

We may premise that there is no class, age, or sex, which, whilst in health, does not absolutely require some form of active exercise to keep it so. Total inactivity, besides being insufferably irksome to the mind, is destructive of all the functions of the body. Speaking roughly, the necessity for exercise, taken as muscular motion, varies nearly in the *inverse ratio to the age of the subject.* After the first year or two of life, the child passes the greater portion of its waking hours in motion; and this remains its habit until the studies required by education place a limit to the time allowed for play. Provided that this play-exercise of young children be alternated with short intervals of rest, it is unnecessary to put any restriction upon its amount, except in the cases of those who possess a delicate organization and the nervous temperament. In such children, the spirits are apt to overrun the bodily powers, and exhaustion, and consequent check to the vital functions, ensue.

Exercise of Children and Youth.—Children who are stinted in exercise in very early life seldom afterwards acquire that ease and grace of motion which we call elegance, that precision of muscular movement which goes by the name of dexterity, which are generally produced by a more liberal treatment in that respect. Their joints are deficient in suppleness, and their action is more limited in extent. A large proportion of the joints of the body are constructed upon the *hinge* principle—as the elbow, the knee, the wrists, fingers, ankle-joints, and toes. In this form of joint the bones are placed in close apposition, and they are bound down by a great number of ligaments or sinews. Some of them are constituted by the union of several small bones, which have but a very

limited motion upon each other. To render the action in this class of joints perfect, frequent motion of the several parts upon each other is necessary, and the synovial fluid which lubricates them must be secreted in good quantity. The opposite condition of inactivity, if continued for more than a very short time, is almost certain to be followed, especially in young subjects, by most serious consequences. From want of proper exercise, the synovial fluid is not secreted in sufficient amount; the ligaments surrounding the joint stiffen and lose their elasticity; and thus the play of the several bones upon each other, always small in amount, is still further reduced in extent. Consequent also upon inactivity, those muscles which move the joints waste and weaken, and physical debility, more or less complete, is permanently established.

Another circumstance which renders a large amount of exercise essential to the health of children is, that their heat-forming powers are less than those of adults, and consequently a more rapid circulation and respiration has to be maintained in them in order to eliminate the due amount of animal heat. Muscular movement conjoined with a proper quantity of warm clothing is the only natural way of exciting these functions to increased activity. This increased respiration of children points to the importance of their breathing a pure atmosphere. Indeed, air and exercise are so intimately blended in their effects, that most writers upon these subjects do not attempt to separate them. The love of logical arrangement, however, and a desire to place causative influences in their natural order of sequence, has already led me to consider the effects of a pure and of an impure atmosphere upon children in the chapter devoted to the subject of *Air*. Now it has been there stated that impurities in the atmosphere operate injuriously upon

the system, not by displacing so much oxygen from the space they occupy, but by their inhalation depressing, or even poisoning, its vital powers. The statement may appear paradoxical, but I believe it cannot be contradicted, that there is greater necessity for exercise (for the purpose of increasing the quantity of air respired) with those who reside in towns, or dwellings where the air is impure, than with persons living in country places with the surrounding air as pure as it is possible to be. And the reason is this—that more oxygen is required to counteract the injurious influence of the impurities taken into the lungs along with the air in towns, or other close and ill-ventilated places of abode. This is why town-bred children should be as much as possible in the open air, and use a great deal of active exercise to increase their respiration.

The great thing to be avoided in the exercise of children is too much formality and regularity in its performance. The staid and formal march of a young ladies' school may be compared to a walking funeral without the corpse; but the dawdling walk of young children by the side of the nurse, who perhaps perambulates the baby at the same time, is equally lugubrious. If the children are lively, they get morose at the delay; if quiet or dull, they miss the excitement which play or running would give to their sluggish frames. Children should be exercised where they can run or walk as the whim of the moment may dictate; and this exercise ought not to be confined to *one* period of the day, but, where circumstances will in any way permit, all under ten years of age should have several distinct play hours.

There are but a very few days in this climate which do not admit, at least in some part of the day, of children going out of doors. Cold winds, or a damp or rainy day, are too often made the excuse for keep-

ing children within doors.* With proper under-clothing, there need be no fear of taking cold during active exercise or play; and indeed, the fear of damp or rain which the majority of people entertain in this country is both unfounded and absurd. Men go hunting and shooting all day long in continued rain, and, even when wet to the skin, so long as they are warm with the exercise, no evil results ensue. The heat of the surface caused by active exertion is quite sufficient to prevent it from being chilled by moisture, and it is only by indiscreetly allowing wet clothes to remain on when, from the termination of the exercise, the blood retires from the skin, causing its temperature to fall, that a cold or other mischief ensues.

The best kind of exercise for all boys—that is, those between the ages of 7 and 16—are games. Walking, so valuable for older people, is not sufficiently exciting for youths under 18. Games of various kinds put into action almost every muscle of the frame; but those of the limbs, of the back and chest, should be exercised the most. The joints should be kept in constant action, whereby the bones will be strengthened and the circulation quickened in every part of the body. Consequently, the blood will be equally distributed to every organ, which receives at the same time that nervous stimulus which excites growth and development.

The exercise of girls, wherein it differs from that of boys, should partake somewhat of the character of that allowed to young or weakly boys. The skipping-rope is, out of all comparison, the finest implement that can be placed in the hands of young girls. Skipping calls into exercise almost every muscle of the body; the muscles of the arm, those of the chest,

* The management of her children in this respect by our beloved Queen has afforded a wholesome example where it was much needed, and is worthy of all praise.

of the whole length of the spine, with those of the thighs and legs, are all nearly equally exercised. The gymnastic pole, and ropes for climbing and raising the body by the arms, are also excellent for girls. Battledore, a good in-doors game, should be played with each hand alternately.

The much-vaunted gymnastic and calisthenic exercises are not nearly so well suited, as a rule, to young children, girls especially, as the games which they invent for themselves. Having only the promotion of health for their object, they are not entered upon with spirit and relish enough to insure the highest results of exercise. If set as a task, they are almost powerless for good, except it be the strengthening of some particular set of muscles, as those of the spine. A child with her skipping-rope will "keep up," out of emulation, to the extent of her powers, and derive all possible benefit from it; but if set as a play-task, to do so many jumps without missing, although the task may be done, the same exhilaration does not follow. So it is with fixed times of play and work. An unexpected holiday, or run at play, is twice as inspiriting as those that have been regularly looked forward to.

Whilst it is certain that too much iteration can scarcely be used in inculcating the use of exercise for growing children and youths, a word of caution must be said against its abuse. In the first place, it must be remembered that the amount of physical as well as mental exertion to which children are subjected must be rather *under* than over that which their powers can bear without injury. In the case of delicate and nervous children, and of those whose muscular development is small, or whose tissues are soft and flabby, we must begin with the gentlest exercises, proceeding by very gradual steps, to those which require more strength of muscle and longer-continued attention. By proceeding thus carefully, perseverance

will be rewarded by converting the puny and delicate child, in a few months, into a robust, firm, and active youth. The intellect will gain strength at the same time, and although the quickness natural to delicate children may be somewhat dulled, the increased power of sustaining the attention upon any subject will more than compensate the loss of the more showy but less durable quality.

Stronger boys are very apt, either out of emulation or bravado, to test their physical powers to the highest point. Incalculable mischief is frequently produced by this practice, if continued for more than a very occasional instance. Boating, and long runs across country, are exercises of this dangerous character. It is not that the muscular system is overtaxed, but the extreme excitement of the circulation so tries the powers of the heart, that, unless it be made of the stoutest stuff, its fibres may be injured, and permanent disease result. Several instances of this melancholy wreck of the vital powers are recorded as the result of rowing-matches, and some also from running. Parents and masters of schools should never allow of these contests unless they are well assured that they will be kept within the bounds of moderation, and only engaged in by those boys whose physique is of the strongest and toughest character.

Of Girls.—There is a means of conducting the exercise of young girls in combination with their mental education which deserves to be more generally known and practised. The weakness of the spine, which so often afflicts growing girls, and which, by mismanagement, is pretty sure to be converted into curvature, has been commented upon by most writers upon the present subject. I have carefully abstained, in the present volume, from mixing up medical speculations, or directions for the treatment of disordered conditions of the system, with general directions for

the preservation of health, as being unfit for the general public; and for this reason I do not here inquire into the physiological determining causes of spinal curvature. The *mechanical* causes of this affection are easily understood, and when known may be easily guarded against.

The most noteworthy circumstance with reference to spinal weakness and curvature, is that it seldom or never afflicts boys. What cause can be assigned for this difference? What is there in the structure or constitution of girls which, *per se*, lays them open to this weakness? The answer is, that the muscles of female children, those of the more easy classes in particular, are softer and possessed of less contractile power than those of boys. With the same weight to carry—the weight of the head, chest, and partly, of the abdomen—the muscles of the girl's back are, as compared to those of boys, over-weighted. Doubtless this would not be the fact if girls were allowed the same means of strengthening their muscles and bones, by means of play and free exercise, as are thought absolutely necessary for boys; but the fact is, that instead of an equal allowance of strong exercise, which would go far to put girls upon a par with boys in this important respect, the greatest care is taken to overtask the strength of the back by a longer continuance in the upright position than they can bear, and to prevent this defect from being compensated by such exercises as would strengthen and consolidate its powers.

There are two diseases which particularly afflict female children in this country. The one, as remarked by Mr. Mayo, in some eloquent words on this subject in the work already quoted, is *Education*. The other I designate as *Nursing the baby!* The first disorder prevails in the palace, the second in the cottage. Education, as conducted in most of the "establishments for young ladies of the higher

classes," requires that the body should be kept in the erect position, or in the upright sitting posture, for many hours of the day. The music-stool, the drawing-chair, lessons, walks, occupy, upon a moderate calculation, ten hours a day; during the whole of which, the spine, with its soft and yielding bones, its tender and delicate muscles, has to support the whole weight of the head, and most of that of the trunk, without resting, or throwing the weight upon any other means of support. The action of the spinal muscles being all this while in the same direction, becomes monotonous and fatiguing in the extreme.

Now the only way in which, according to the present habits of education, this disadvantage can be met, is by strengthening the muscles of the back by such exercises as will call them into different modes of action; and this may be done by due attention to the games already indicated, and by relieving the spine of the weight upon it for a larger portion of the day. One great difficulty is, that weakly children are so tired with the work which the back has to do at lessons, &c., that play has no charms for them, and they betake themselves to reading or lounging about, from which no good, but further harm, accrues. The remedy in this, as indeed in all cases of the same nature, is to be sought in a thorough change in the habits of tuition as applied to girls. Whilst at work, more free and easy attitudes should be allowed, and the upright position, whether standing or sitting, should be constantly alternated with the recumbent posture. By this means, a frequent change of the action of the muscles of the spine, and a longer time during which the weight will be removed from pressing perpendicularly downwards, will be secured.*

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* *Spinal Curvature.*—After much discordant theory and long discussion, the following, I believe, may be taken as the most useful directions for avoiding the occurrence of spinal curvature and its

All thoughtful persons must have reflected upon the difference between the habits of the English, and other inhabitants of Northern countries, and those of more Southern people in respect of the supine position. In Italy, Spain, and throughout the East, women of the better classes pass most of their time in recumbence; whilst those of the Northern nations seldom, unless it be in illness, indulge, except for very short periods at a time, in a lounge on the sofa or the ottoman. And what is the result of this difference in habit? No finer figures, no more elastic and graceful female forms, are to be met with in the world than in the countries where this practice of

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accompanying distortion of chest and limbs, and of remedying it when once formed. In nineteen cases out of twenty, crook-back results from weakness of some of the ligaments and muscles which support and move the spine, or from irregularity of strength in their various parts. The age of curvature is from eight to eighteen; the subjects most liable to it are delicate children of the upper and middle classes, particularly school-girls. At this tender age, the bones, ligaments, and muscles of the spine have not yet acquired that consolidation and firmness which is necessary to support the weight of the head, shoulders, and chest. In the girl, too, the muscles are weaker and more slender than in boys, whilst the weight to be borne is scarcely less. The prevention of this sad disappointment is sufficiently easy, if only a few common-sense rules be observed. The first thing is to see that the food is sufficient, and possessed of nourishing qualities, and that exercise to procure appetite and power to digest the food be regularly taken. It is in these prerequisites to a healthy structure that school-girls are so often deficient. The starting-point is want of *active* exercise. Food may be taken in sufficient quantity, but it is not properly digested, nor is good red blood elaborated from it. Then comes the standing or sitting posture, often in a constrained position, for many hours a day, in writing, drawing, or playing musical instruments. Now it is that the weakened muscles of the back give way. The child naturally throws the weight of the body on to the stronger side, by standing on one leg, or leaning sideways over the desk or table. The spine is drawn over to the side of the stronger muscles, and *one* curvature is now formed; whilst, in order to balance the weight of the body, and keep the head in an erect position, a *second* curve immediately follows the first.

The prevention and remedy for this disease are as simple as is the

recumbence prevails. All travellers agree upon the rarity of deformity amongst the women of Southern nations. And yet the women of the poorer classes there are subjected to severe labour, frequently carrying on their heads burdens which no English female could endure. Such is not the case in Northern countries. Female deformity is there frequently met with, and inability to carry themselves erect for any length of time, without pain and fatigue, is no uncommon result of overstrained action of the spinal muscles in early youth.

As soon as the upright position becomes irksome or fatiguing, it should be intermitted, and weakly girls should be allowed to read or learn lessons whilst reclining upon the back or side, upon a sofa or easy-

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mode of its production. The muscles must he strengthened hy regular exercise; and that is the hest exercise which calls all the muscles on each side of the spine into action. Nothing beats the old skipping-rope for the purpose; in fact, it is the perfection of exercise. The swing of the arms expands the chest and strengthens the respiratory muscles, therehy giving room for the admission of a larger amount of air to the lungs. The rapid hending of the body, and the jump, exercises every muscle of the back and hips equally. But the swing-rope, and the rest of the calisthenic apparatus, are also useful. Great fatigue must always be avoided, whether curvature has already taken place, or is only impending.

When curvature has already occurred, the patient must not he taken to a quack or a specialist, to have all sorts of irons and cramping bandages applied. Gentle, but frequent and regular exercise must he used, *always short of fatigue;* a little skipping, light dumh-bells, or the swing-rope, will answer the purpose hetter than long walks. The patient must maintain the erect position hut for a *very short period at once;* and then the horizontal position must be immediately resorted to. Alternations of *short* periods of activity with *long* ones of repose, several times a-day, succeed the best. For repose, a sofa with a hair mattress, and with a cushion to rest the arms and forehead upon, is far preferable to the old-fashioned hack-board, or Verral's apparatus may be used. In any case, the patient should lie principally on her face, as the spine is thus placed in a hetter position for falling into its normal shape than when the supine posture is adopted. In this position the weight of the body is taken from off the spine and thrown upon the chest and abdomen resting upon the couch.

backed chair. Lying upon the backboard is not nearly so refreshing as a lounge upon a sofa, because there is no change of position, and the muscles are kept more upon the stretch. Not less than three hours of every day ought to be passed on the lounge by delicate girls, and, in extreme cases, the upright position should not be maintained beyond an hour at one time. This alternation of the erect and the supine posture should be further varied by such games as, whilst they do not fatigue, change the action of the muscles of the arms, trunk, and spine; and of these, running, skipping, and dancing are the best.

Another point which should not be lost sight of in the education of youth of either sex, is the equal exercise of both sides of the body. Much good, and no harm, arises from bning ambidexter, or right-handed on both sides. Without doing away with the exclusive use of the right hand for the finer operations of writing, drawing, sewing, &c., in all movements of a coarser nature, requiring strength rather than dexterity, the two arms and hands should be exercised indifferently; so as to balance the power of the muscles on either side. This is why left-handed people are often stronger, and, to use a verbal contradiction, more *adroit* in many ways than those who use only the right arm on all occasions.

Exercise of Adults.—The day labourer requires no walk to obtain an appetite, no dinner-pill to assist his digestion, nor composing draught to lull him to sleep. Trace back this fact to its origin, and what do we learn? That continual bodily exercise is the natural condition of man? By no means. The lazy Asiatic considers exercise as an evil, an abnormal condition of the body, and repose and abstraction as the true elysium. To his mind there is no snake in the grassy shade under which he smokes his everlasting tchibouke. The *dolce far niente* and the

desipere in loco are not followed by any of the pains and penalties of ill health as the cost of his indulgence in them. In truth, exercise for the mere purpose of preserving health is altogether an idea of the northern mind, and of modern origin. It is the result of some of those abnormal conditions of body and mind which civilization produces. Labour, as distinct from exercise, is the lot of the great majority of mankind; but labour with the mind—mental work not conjoined with that of the body, is the creation of civilization; and, although not on that account unnatural, is incomplete and injurious as a continuous and regular habit.

I do not forget how much athletic sports and exercises were practised and encouraged in ancient Greece and her dependencies in Asia and Europe, and also by the educated of the Roman capital. The Olympic games, however, were constituted for the correction of the tendency to luxury and ease induced by the Greek character and climate, as well as to inure the youth to deeds of daring and feats of strength calculated to be of immense service against their enemies in the field of battle. No doubt the legislators of ancient Greece were well aware that, in encouraging and fostering these games, they were developing the health and bodily vigour of youth at the same time that national courage and pride of race were heightened and confirmed. We know also that such men as Plato, Demosthenes, Cicero, Julius Cæsar, and many others, practised these exercises for the benefit of their own health and the enlarging of their powers of endurance. There was, however, no large class of persons, in ancient times, to whom regular physical exercise was, as it is to the modern brain-worker, a matter of life and death, a subject to be followed out by the laws of physiological science.

In order to estimate, with any approach to pre-

cision, the amount and kind of exercise suitable to grown-up people, regard must be had to the kind of employment, season of the year, mode and habits of life, and constitutional temperament of different classes of people. There is one class, however, and that perhaps the largest of all, about whom we need not trouble ourselves in regard to exercise. This class embraces all persons who are employed out of doors, or *very actively* within doors, for the greater part of the day. These require no other exercise than what their daily avocations necessitate; occasional sport, or change of scene, being sufficient for them. It is the sedentary inmate of the shop, the office, the counting-house, or the study, on whose behalf the philosophy of exercise must be scanned. This class is further augmented by the large numbers whose labour in-doors, though not sedentary, is yet of too light a description to give the muscular and vascular systems that due development necessary for the circulation of healthy blood, and for the proper maintenance of the various secretions of the body.

The degree in which labour may be said to be salubrious, both in the open air and within doors, may be thus tabulated from the researches of the Sanitary Commissioners, and others conversant with the subject of public health :—

1. Light labour, out of doors, in the country.
2. Light labour, in-doors, in the country.
3. Hard labour, out of doors, in the country.
4. Light labour, in-doors, in towns.
5. Hard labour, in-doors, in towns.
6. Labour altogether sedentary, in towns.

From this table it will be seen that even hard labour (not in itself a source of health) in the open air is less destructive to life, and injurious to physical well-being, than light labour, in-doors, in large towns

or in confined dwellings; and that the lowest employments, in point of salubrity, are the sedentary occupations to which the increasing demands of an advancing civilization condemn an ever increasing number of our countrymen and countrywomen. It would, however, be to deceive ourselves were we to attribute all the evils of such occupations to their merely sedentary and immobile nature. These employments are exactly those which admit of a large number of persons being crowded within a too confined area, exposed to the heated atmosphere and injurious exhalations which are inseparable from the crowding of a number of human beings together for many hours, often too many hours, of the day. Indeed, so much of the mischief is due to this latter cause, that the man who scrapes the streets or carries a load of bricks on his head in the open air, exposed to all weathers and faring the worst of all men as to his diet, has greater chances of attaining a hale old age than the tailor or milliner working in a crowded garret has of arriving at old age at all.

It is then for the sedentary workers, whether with body or brain, shut up for the greater part of the day in-doors, that the term "*Air and Exercise*" has a meaning which neither of the words carry with them singly. Yet, as has already been remarked, exercise, even in a polluted atmosphere, is better than total inactivity. Experience shows, however, that such air has not the invigorating properties which a pure atmosphere lends to muscular exertion; and indeed, persons soon tire of, and cease to enjoy, such exertion made within doors for the mere purposes of health.

Exercise must be apportioned to the Vital Powers of the Individual.—There is no greater fallacy current amongst the vast number of unsound notions which possess the minds of the public, than the belief that the amount of exercise which would be

beneficial to them is only bounded by their capacity to take it. Whether it be taken with a view to strengthen the muscles, or to invigorate the vascular and nervous systems, exercise should always be gradual in its increase, and accommodated to the *present* state of the vital powers of the individual. We are not to consider that, because we were once capable of walking so many miles without fatigue, or of performing some severe gymnastic feat, we are to try to keep up this power indefinitely when the body, from age or disease, has become permanently less robust. When, after many years of confinement to the desk or counter, the muscles have softened, the tissues of the heart have become weak and flabby, the cells of the lungs have lost their elasticity, it is no longer a question of gymnastic training or other violent exertion. All that can safely be borne is regular and easy exercise of the body, *continued over a long period*, so as to give tone to the vital functions without producing the exhaustion which inevitably follows upon any excessive demand upon their powers.

In mechanics, time is equivalent to speed. What cannot be effected by the one may be extracted from the other. Sudden and uncertain displays of force are not of any service to persons of sedentary habits; to derive permanent benefit they must extend more gentle efforts over a considerable period, and that with regularity. By these means, many persons whose health has suffered almost irretrievable injury from long confinement to business of too engrossing a nature (the over-activity of the brain having drained away the energies of the other organs), have obtained a more or less complete restoration to health. With such persons, a reduction of the demands upon the mental powers, a careful change of habit, with temporary repose of mind, will effect a

wonderful improvement, and extend the powers of exertion to a period far beyond what would be attainable under the system of perpetual labour for ten or eleven months of the year, with one or two of entire holiday.

Another error of a seductive character prevails, especially amongst younger men of business. It is their belief that a short period of very active exertion—the use of dumb-bells or other gymnastics, boating, or hard walking against time—will compensate them for inactivity for the remainder of the twenty-four hours. Here *speed* is not the equivalent of *time*. That is to say, a great amount of force exerted over a very short period is by no means equal in point of salubrity to a smaller display of power carried on for a longer period. This principle obtains throughout the whole animal economy. The fast coach-horse, doing twelve miles an hour once in the day, was knocked up in a year or two, whilst the cart-horse will walk forty miles a day, four miles an hour, for many long years, working to the very end. There are no lasting effects in the organic world without length of time in the production. All violent efforts are followed by exhaustion, not only of the part exercised, but also, in proportion, of the whole of the vital forces. This exhaustion seems to be owing to the cessation of the nutrition of the part, the result of the withdrawal of the flux of nervous force to it. The oftener these *temporary* violent demands upon the strength of any organ or limb are made, the more completely is its growth and renewal impeded, and thus permanent deterioration of structure follows.

A third error is often committed by those who have drawn during the day very largely upon the nervous force either in study or in the management of important and complicated affairs, or the super-

vision of large numbers of people. They imagine that the drain upon the vital powers in one direction must be balanced by a corresponding exertion of them in another and opposite direction. They therefore proceed to exercise their muscular powers, and to tax their digestion to an extent far beyond their natural ability. This is a great mistake. There is only a certain amount of vital force which it is possible for any individual to exert with safety within a certain period; for instance, between rising from rest, and seeking rest again. If this energy has been all, or nearly all, expended in one direction, whether towards the brain, as in the case of the mind-worker, or towards the muscles, as in that of the body-worker, it is impossible that any large amount should remain to be devoted to the opposite kind of effort.

Where circumstances absolutely require that, for a time, all the vital powers should be expended in mental effort, as in composition against time, or the unravelling of complicated affairs, we must be content with a very moderate exertion of those of the body. All violent exercise must be avoided, and as much time as can possibly be withdrawn from brain-work should be devoted to walking, riding, light gardening, or any other easy employment by which the mind will be amused without the attention being overtaxed, and the muscular system exercised without fatigue. Whenever a holiday can be taken, it should be spent in such manner as to embrace as great a change of scene, of ideas, and of bodily motion as possible. To this end the weekly holiday or half-holiday, now becoming more and more general amongst the mercantile classes, is a movement in the right direction; of more benefit than the annual holiday now taken by most persons whose brains are exhausted by concentration of the mind upon the same class of ideas for ten or eleven months together.

Period of the Day for Exercise.—The groove into which we have got as regards the time of occupation, is the result of various causes which have combined to bring the habit of the different classes of society into a systematic uniformity which it would be very difficult for any individual to run counter to. The hours of labour, of attendance upon office or public duty, are a sort of compromise to suit the convenience of the great majority of people. Doubtless this tacit understanding acts injuriously upon those who are engaged in certain exceptional employments; but upon the whole, the hours of labour which society has fixed upon are the best under the present aspect of civilization.

The daily walk to and from the office, counting-house, or shop, is for the majority of the dwellers in towns all the exercise which is obtainable. We may deplore that it is so, but unless all classes would consent to a daily cessation in the midst of work, it is not possible for a few to adopt it. There is no doubt, at the same time, that the stretch of exertion is too long, and that an interruption of work for an hour or two in the middle of the day would be an immense relief. During this intermission a light meal might be taken, and moderate bodily exercise afterwards would assist its digestion and refresh the mind for further exertion. Little further exercise would then be required after the day's work is ended, and the evening might be devoted to the amenities of social intercourse or to study, without the accompaniment of that *ennui* and languor which now too often characterize what is called society. In fact, the custom of the noon-day siesta so universal in hot climates, might be imitated, with modifications according to climate, in this country, with the greatest advantage. This siesta would divide the day into two equal parts, the first beginning earlier in the morning by an hour than is now the

custom. The noon-day meal and rest, with good digestion, would support the functions in full vigour to the close of day; and sleep, now too often broken by the extreme fatigue and exhaustion of the system, would be more refreshing and of shorter duration.

Exercise of Weakly, Invalid, or Aged Persons.— The condition of the body as regards food and sleep must be taken into account in directing the exercise of invalids and persons of weak organization; amongst whom a large proportion of females of the upper and middle classes may be ranked. Exercise ought not to be taken when the system is empty, nor immediately after any meal, except it be a very light one. The physiological reason for this is, that exhaustion is apt to be produced, and the loss of nervous power consequent upon it causes a flagging of all the vital actions. There is an old-fashioned prejudice in favour of exercise before breakfast, which indeed may suit strong and healthy people well enough, but which is quite inapplicable to the weak and delicate. On first rising in the morning, the functions have not attained their full vigour, owing to the length of time that has elapsed since the introduction of food. The pulse is at this time lower and weaker than at any other period of the day, and the skin, relaxed by the warmth of the bed and by sleep, possesses less power of resistance, and is very susceptible to cold. For this reason, delicate people feel the chill morning air keenly, the contrast between the atmosphere of the bedroom and that of the outer air being too strong, and they require to be supported by breakfast before they can safely brave any amount of exercise out of doors. Some persons, indeed, do not recover from this feeling of weakness during the whole of the forenoon, and only acquire their full powers after having taken a second meal. Leaving aside these exceptional cases, the best time for exercise is about an

hour after breakfast; but this should not be severe nor very prolonged. Those who have leisure, or who pass many hours a day in sedentary labour in-doors, should interpose *two or three short intervals of exercise or recreation* amongst those devoted to occupation.

When only a luncheon or a light meal is taken in the middle of the day, exercise may follow immediately after it, and may be continued for a considerable period; but when dinner, as the chief meal of the day, is taken early, not less than *two* hours' rest should precede any very active exercise.

As weakly people should eat oftener than the robust, because they must eat less, so they should take more frequent exercise, because they are easily fatigued.

Exercise as regards Temperament.—Next to delicacy of constitutional powers, temperament requires to be considered in apportioning exercise to any individual case. I have already remarked, when speaking of temperament generally, that the habits of life should be conformable in some degree to the proclivities which the peculiar temperament of a person engenders. Thus the sanguine, full of life and activity, chafe at close confinement to the desk or counter, and very often their reluctance to engage in sedentary occupations is looked upon as mere stubbornness or self-will. We should be careful in drawing such a conclusion, for the impulses of youth are very much under the inexorable dominion of bodily constitution and the temperament of their minds. No doubt, early training may do much to modify both, but I am nevertheless fully convinced that the study of the peculiarities of personal temper, whether affecting the body or the mind, is too much neglected in choosing a profession for youth and that a much higher degree of success would follow a closer attention to their natural aptitudes.

The lymphatic temperament—that degeneration of the sanguine—also requires a good deal of active exercise to expend the surplus juices of the body and to give that firmness of fibre in which it is so deficient.

Individuals of the bilious temperament, characterized by dark hair and swarthy complexion, are more tolerant of confinement within doors, and are able to endure sedentary labour with less relaxation than those of any other temperament.

Season.—Season has an influenee on the value of exercise which is much misunderstood. It is thought that the seasons of fine weather, spring and summer, are those in which exercise is most required. This idea is not supported by physiology, nor is it in accordance with the practice of the inhabitants of hot climates. In point of fact, the warmth of summer is of itself the means of effecting in great measure the same result, viz., good circulation in regard to the vital functions, which, in cold weather is only to be obtained by exercise. In this view, it follows that for a large number of people, the weakly and the aged in particular, *passive* exercise is sufficient in hot weather, provided it be taken in an open and salubrious atmosphere.

Age.—Many aged people erroneously suppose that they shall maintain their vital powers in almost pristine activity by taking the same or nearly the same amount of exercise as in former days. And, provided they have a good digestion, this may frequently be done. We hear of hale and hearty people from 70 to 80 years of age boasting that their powers are not diminished, and that they are as apt for business or even pleasure as they were in their best days. These are exceptions, however, and like *ignes fatui*, they are likely to lead others away to their destruction. As a rule, old people should

keep their exertion carefully *short of fatigue*, as all over expenditure of strength is very likely to exhaust the force of some weak organ, when irreparable mischief may result.

Maintaining the erect position for a great length of time is very injurious to weakly and aged people. By doing so, the heart is taxed beyond its powers to overcome the weight of the column of blood, which in the veins presses backwards against it, and it not unfrequently faints, or even sinks under the load.

Concentration of all the efforts, either of body or mind, upon one object for a great length of time is also very injurious, particularly to aged and delicate people. Extreme exhaustion of one organ or set of organs, reacts injuriously upon all the others. Indeed, a caution is required for all ages and constitutions against too great devotion to one object of pursuit.*

On the other hand, a division of the powers and devotion of them to two separate objects *at the same time* is to be avoided. Thus persons of weak digestion should on no account use active exercise imme-

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* An author whom I have already quoted wrote thirty years ago to the same effect. "This principle of equilibrium (in labour and exercise) is one well deserving of our attention. It probably enters more largely into the subject of healthy exercise than any other element, and its disruption is one of the most extensive and influential errors and sources of suffering embraced by the science of hygiene." . . . . "The attainment of excellence, in our limited view, seems to require the concentration of the powers on a single design. But where this only calls into operation a small portion of the human faculties, and where it is too closely and too strictly followed, the other capacities soon begin to complain, and, without care, the system is quickly deranged; therefore, the only mode of acquiring anything like perfection is to aim at the exercise of the *whole man*—the maintenance of that balance between the animal, bodily, and the spiritual and refined powers, which shall allow the inordinate supremacy of none."—Mr. J. B. Davies' "Manual of Popular Hygiene," 1836.

diately after the principal meal. This applies equally to mental as to corporeal exertion. In either case, the blood and nervous force are diverted from the stomach at the time when both are wanted there, to the brain or to the muscular system. The time best suited to the greatest bodily or mental efforts is when the new blood formed from the food is thrown into and thoroughly mixed with the general current of the circulation. This takes place at a period varying from two to five hours after a meal. Thus an empty stomach, but not exhausted system, is most suitable for great mental efforts. It is then that the thoughts are the clearest and the memory the readiest, and this time, with people in the vigour of health, is on first awakening in the morning. Healthy persons can do a good deal of work before breakfast, assisted in the case of brain-work by a cup of black tea. This extreme acuteness of the mental perceptions in early morning does not last long, but the quality is so fine that every appliance should be at hand to prevent its being lost. Those who desire to retain the finest thoughts or best resolves of the newly-awakened brain should be provided with pencil and paper, by the bedside even, that nothing be lost of these too fleeting rays of the light divine.

BATHING.

Washing; Bathing; Different kinds of Baths; best Time for Bathing ; Age, &c.—It is the Nemesis of the systematic writer who delights to keep his thoughts in logical order, and the expression of them in sequential arrangement, to find that there are several outlying portions of his domain which cannot be included within the ring-fence of his general plan. All that he can do in such a case is to see to which of his principal divisions they lie the closest, and to

tack them on to that subject to which they seem most germane.

The subject of bathing, which by the way is not one of the essentials of life, although it is of comfort and high health, seems to fall nearly within the domain of exercise, since a great part of its value consists in the muscular motion required to perform it effectually, and in the natural reaction which follows that muscular exertion. In short, bathing and sponging may be called the *exercise* of cleanliness.

There is a little confusion existing in some minds as to the relative meaning of the terms bathing and washing. It is highly necessary to have clear notions of the distinction between the two operations, and of the effects of each. Thus, those who have not the means of bathing, or who are deterred from using it on account of health, should be enabled to estimate the value of what they can use in the way of washing, and of what they lose in the way of bathing. Bathing and simple washing of the skin have but little necessary connexion. If the latter is properly performed, the former is reduced to a mere luxury, or at least to a feeble remedial agent.

Washing.—As utility is before ornament, and health before pleasure, I am bound to accord the first place in this section to washing. The word may appear common and the subject trite, but that is an additional reason why we should not it pass over without examination, as the very commonness of the operation proves it to be one of paramount utility. Further to justify the few observations here made upon the subject, I assert that the great majority of people *do not know how to wash themselves properly;* that is, with the utmost efficiency, and with the greatest economy of time, labour, and material. It may be said that water is cheap enough, and so is soap; but labour and time are not always so, and this it is

which leads many to neglect the proper care of their persons. To put them in the way of quickly, cheaply, and effectually cleansing their skin, so as not *necessarily* to require those periodical bathings and scrubbings which are too often a bugbear to old and young, rich and poor, ought not to be below the dignity of a writer upon general hygiene.

The old adage that cleanliness is next to godliness, must have had its origin in the feeling of moral elevation which generally accompanies scrupulous bodily purity. Personal cleanliness, when grown into a habit, draws after it so many excellences, that it may well be called a social virtue. Without it, refined intercourse would be impossible; for its neglect not only indicates a want of proper self-respect, but a disrespect of the feelings of others which argues a low tone of the moral sense. All nations, as they advance in civilization and refinement of manners, pay increased attention to the purity of the person. In fact, the estimation of the value of personal purity is a kind of "muscular religion" which will be found (however ridiculed by a certain class of religious ascetics) to be highly conducive to the elevation of the whole nature of man.

The necessity for washing the skin (as distinct from bathing) arises from the nature of its secretion. Some whimsical philosophers have indeed disputed the necessity for washing at all, as, for instance, the author of the 'Original'; maintaining that the skin possesses a self-cleansing power, and that we have only to let it alone, and it will throw off all dirt by a force from within. If the cutaneous secretion were a watery one simply, this might be so; but the perspiration, both sensible and insensible, contains a quantity of oily and other animal matter and salts, which, mingling with the dust and flue of the clothing, adheres closely to the skin, and fills up the

minute pores of the perspiratory glands. The unwashed skin in time becomes plastered over with a sort of varnish, composed of the secretions mixed with dust and other matters, a portion of which are composed of the scurf or worn-off scales of the skin itself. In this way the pores, hundreds of which open upon every square inch of surface, become clogged, and the secretion is retained behind in the vascular tissue, where it gives rise to various loathsome and troublesome diseases. To admit the free passage outward of the perspiration is almost as important as to allow the ready exit of the foul air from the lungs. Total obstruction, in both cases, is followed by instant death, and partial closure reacts so injuriously upon the other functions as, although more slowly not less surely, to induce disease and premature death.*

The *quantity* of washing required will depend upon the activity of the perspiring function of the skin, and the readiness with which dust or dirt of any kind gains access to it. Under all circumstances, however, except in diseased or very enfeebled habits, the whole of the skin, except the hairy scalp, ought to be well washed over *once every day*. This washing may be made a bugbear, especially to children, and a discomfort to weakly people, or a delight and pleasure to all, by the manner in which it is performed. It may take the place of bathing, either entirely, or by the use of a bath very occasionally. It may be made to stimulate or to soothe the general system, as may be required. It may even be used to restore

* If the access of air be excluded from the *whole* cutaneous surface death very speedily arrives, as has been experienced in the case of persons buried in earth, although air may have reached the lungs ; and in the celebrated case already referred to, of the child whom Pope Leo caused to be made an angel of by coating the skin all over with gold-leaf.

the disordered action of other organs, and so raised to the dignity of a remedial agent.

The typical washing, then, for all except the invalid or very aged, I take to be the following, which is based upon three designs. The first is to remove dirt, and open the pores; the second is to refresh the system generally; and the third to soothe the nerves of the skin and prevent cutaneous eruptions. To effect all these objects, soft water, mild soap, (for occasional use only), two towels, a soft and a rough one, and *ten* minutes of time, are the only requisites. According to the temperature of the season, cold, cool, or tepid water will be required. The moment of rising from bed is the proper time for washing; no other time answers so effectually as this. The body is warm, and therefore can withstand *moderately* cold or cool water better than at any other time. It is relaxed, and requires gentle bracing, and the nerves, deadened by the night's repose, require a gentle stimulus.

The proper mode of performing the morning ablution is the following:—Immediately on rising, being prepared with a large basin of water (where obtainable, a sitz or a sponging-bath will be preferable, but by no means essential), all covering is to be completely removed from the body, so that the cool air may prepare the skin for the subsequent stages of the process. If there are any remains of perspiration, it is to be first carefully wiped off with a soft towel. Taking now a large sponge, or a piece of soft flannel well soaked in water, rapidly rub over every part of the skin, beginning with the neck, chest, and loins, and then proceeding to the limbs. If the surface be rough, hard, or dirty from neglect, mild soap must be used for a few mornings, and once a week afterwards; the more frequent use of soap is hurtful rather than beneficial to many tender skins from its

irritating qualities. Washing, which need not occupy more than three or four minutes, is to be succeeded by gently drying the skin with a soft towel, and when quite dry, a rough towel, Turkish rubber, or, in some cases, the flesh-brush, is to be passed rapidly over every part of the body for four or five minutes more; by which time the skin will assume a red tint and glow with warmth. The chest and abdomen, and the joints of the lower limbs, should receive the principal rubbing. The roughness of the towel must be accommodated to the condition of the skin. For children, women of the sanguine complexion, or otherwise of irritable skin, nothing harder than a common towel is needful. For the pale or darker skins, a Turkish rubber, and for persons who are easily chilled, or with cold extremities, the flesh-brush will be most useful. Anyhow, a gentle warmth *must* be produced, otherwise the person will feel chill and languid for some time afterwards.

If a sponging-bath be at hand (as in all cases where it can be afforded it should be), the person should sit in it with sufficient water to reach the hips, and well rub the surface of the trunk; afterwards, standing in it for a minute, do the same with the legs and feet. In this way the extremities are less chilled than the trunk, and in cases of debility of circulation, where the feet and legs are habitually cold, they may be rubbed whilst hanging over the bath in which the person is sitting, without being put into the water at all.

What is there in this process, purposely detailed here, which may not be performed by or for every individual in moderate health every morning of his or her life? There is no expense of material nor of time. An active person may easily go through it, including dressing, in twenty minutes. Ladies may take a somewhat longer time, but women of the lower classes can dress as quickly as men. It can be done

in the dark as well as by daylight, and with persons too feeble to use sufficient rubbing, the difficulty can easily be got over in the case of married people, and children and young girls should be taught to assist each other. It is a very pretty sight to see a bevy of little children thus washing and rubbing one another, which has also a good effect in accustoming them to the innocent sight of nudity, the too early consciousness of which is a certain sign of vicious training of the mind.

By steadily practising washing of the whole surface as above described, bathing, which to many, the women of the lower classes especially, is not easily obtainable, may in most cases be dispensed with, or used only as an occasional luxury. Without practising it, no person can enjoy the highest state of comfort of bodily feeling and of vigorous health, of which he is capable. Those who habitually perform it would not on any account lay it aside, and they have the consciousness (a very pleasant feeling *to ladies*) of possessing the most delicately clean and soft skin whenever fashion, affection, or accident calls for its partial exposure. The skin becomes elastic and soft as velvet, it loses the tendency to shrivel and contract on the application of temporary cold, and the power of resisting changes of temperature without detriment is very materially increased.*

But why dwell so long upon so obvious a duty as

* No lady who values a delicately smooth and clear skin, according to the shade of her complexion, should neglect this daily ablution of the *whole* surface. The muddy brown look which the neglected skin assumes cannot be removed by washing the *face and neck* alone. The whole extent of the skin sympathizes with every portion of it; accordingly, to obtain healthy action of a part, the whole of it must be placed in a favourable condition. Not only is the colour and clearness of the skin improved by daily washing, but the secretions become more healthy; and the odour which, from an impure skin, is often so disagreeable, either vanishes altogether, or is replaced by that indefinable but most recognisable aura which we commonly designate as "sweet-smelling breath."

washing, and one so well understood? Because it is *not* practised. Every medical practitioner must have observed how sadly this complete washing of the surface is neglected, not only by the poor, but even by men of business and women of *quasi*-refinement of mind. Amongst the poor there is a general neglect of washing. The men and young lads try to make up for this neglect by an occasional bath in summer, but the girls and women do not even do this. How often have I seen a fine grown girl, whose outward dress is all tolerably neat, and often gaudy, when for any purpose the skin has been exposed, exhibit parts of the body ingrouted with dirt, the legs especially, where the real skin has not seen the light for many a day by reason of the varnish with which it is covered. No wonder that, amongst such, chest affections should be so rife; for in these cases the lungs have to do not only their own heavy duty, but that of the skin is thrust upon them also.

There are a few modifications with regard to this complete washing, which should not be omitted in this place. The strong and youthful may convert this washing into a bath with advantage. In this case, cold water in summer, and in winter, water not under 55° should be used. Five minutes' immersion may be allowed, not more. Hard rubbing after this will bring on the reaction of the skin which gives such great value to cold bathing. For persons not very robust, the temperature of the water should always follow that of the season of the year. No water will be too cold in very hot weather, but as the heat falls, that of the water must be raised, and in winter, slightly tepid, or at most only cool water, should be used. A good guide to the proper temperature of the water will be that of the air of the dressing-room. In summer, water fresh from the cistern may be used; in spring and autumn it will acquire a fair temperature by standing all night in the room; in winter,

it should be raised to 60° or 65°, according to the feelings of the individual.

Many persons in the height of summer are often tempted, when dusty or heated, to have a bath, which, however, consumes time. The same refreshment may be obtained more rapidly, and often more safely, by going to the dressing-room and washing the surface in the same way as in the morning.

Great care must be taken, with old people and young or delicate children, not to use water that is hard, or of too low a temperature; and a feeling of warmth coming on a few minutes after washing should always be secured. If it be long in coming, the circulation may be assisted by a brisk walk or run before breakfast.

Bathing.—I shall have the less to say upon bathing, after what I have thought it necessary to say with regard to washing, because it is reduced, by the steady performance of the latter, to a luxury, or at most, to a means of acquiring vigour after disease or ill-health.

The objects contemplated by the bath are often twofold—viz., cleansing the skin from impurities, and enjoying the luxury or excitement of immersion of some duration in water. With the first we have now nothing to do, since, to obtain it, the same process must be gone through in the bath as that just described under the head of ablution. Bathing simply, then, we understand to be used for the purposes of pleasure or of increasing health, independently of the proper function of the skin—viz., perspiration. For both of these purposes, water at every temperature between 33° and 100° may be made use of, but not by all persons, or without proper reasons for its selection.

Four kinds of bath, as regards temperature, are generally acknowledged—viz., cold, cool proceeding to tepid, warm, and hot baths. A cold bath ranges from one degree above that of ice, 33° to 55° or 60° in winter, and from 65° to 70° or 75°, according to

the heat of the weather, in summer. A cool bath may be of any degree of heat from 65° to 82°; after which, to 92°, it becomes tepid. Warm baths are generally understood to vary from 92° to 98°, according to the feelings of the individual and the temperature of the atmosphere; and from 98° to 110°, the highest point at which it can be borne without inflaming the skin and producing dangerous effects, is designated a hot bath.

I have said that when washing is properly performed, and the skin kept in perfect order, bathing cannot be looked upon as an operation *necessary* to health. It possesses so many advantages, however, and is the source of so much physical gratification, that its practice is, and always will be, popular, especially with the leisured classes.

The physiological effects of each kind of bath should be understood before the bather makes his selection, or practises any one of them in a systematic manner. I shall therefore give a concise account of the effects which each kind of bath produces upon the system, both immediately and permanently.

1st. *Cold Baths.*—The first effect of the cold bath is to depress the vital powers, or rather to drive them in upon themselves, depending upon their innate force to produce a reaction. By reaction, in this sense, is not meant an absolute increase of vital power, but a greater outward manifestation of it upon the skin and muscular system. This depression, or repression, lasts for a longer or shorter period, according to the degrce of the shock, and to the vigour of the powers of life. Very healthy subjects have nothing to fear from the first depression, providcd the bath be taken under proper circumstances, and continued only for a proper length of time. If the cold be not too long applied, the heart, stimulated by the cxcess of blood accumulated in it, increases its pulsations, both in

rapidity and strength. This, and this alone, is the secret of the beneficial effect of cold bathing. If this effect be not produced, then nothing but evil will result from its use. It is calling the heart into increased action—exercise—and thereby distributing the blood more rapidly and more freely through every organ of the body. Every physiologist knows the valuable effects produced by this acceleration of the heart's action. Passive congestions of the lungs, liver, brain, or indeed of any organ of the body, are more readily dissipated by this means than by almost any other; and organs which have not received their due amount of the circulating fluids receive a new impetus which acts beneficially upon their nutrition. Thus, both general and local cold bathing is of use in restoring weakened and wasted parts to their proper balance, so that the popular use of the pump in the chronic stage of injuries to the joints or limbs is founded upon sound physiological as well as empirical axioms.

The proper temperature at which to take a cold bath depends upon the object in view. If it be used to invigorate a weakened system or part, the shock must be of *short* duration, and followed by *long-continued* friction to insure complete reaction. Weakly persons, especially boys ambitious of doing as others do, run great risks, and indeed often increase their debility, by inattention to this canon of bathing. The sudden plunge is undoubtedly the best for strong people, but it is too severe for the delicate. With them, the face, neck, and chest should be first wiped over with the towel well wetted in the bath, and then the whole body may be immersed. It is very bad to get into the bath and stand in it with the water only covering the legs and lower part of the body; by so doing, the heart and central organs become so highly congested that perfect reaction is beyond their powers, and cold extremities, languor, and chill con-

tinue for many hours, debilitating the muscles and depressing the mind.

We not uncommonly find persons who, having made a practice of daily cold bathing in the warmer seasons of the year, think they do well to continue it through the winter. I have known such an enthusiast frequently break the ice to enable him to carry out what must be considered as a hobby, some would say a mania. It is doubtful whether these persons are the better for continuing the use of severe cold so systematically; and it is perhaps the habit which alone insures the safety of the practice. It may be questioned if calling upon the bodily powers daily to sustain a shock, and to make a violent effort of reaction quite beyond the demands of normal function, be not detrimental to the powers of life, and liable to induce their premature exhaustion.

But cold bathing may be much more frequently, and indeed systematically used than it is, without producing shock or reaction, except in a very moderate degree. And it is this use of it which refreshes and invigorates the system with the greatest certainty, and with the least expenditure of strength. For this purpose, cold bathing is inapplicable in very cold weather, and to persons in very delicate health and of weak circulation. The use of the bath within doors, whether slipper, sitz, or sponging bath, is the most conducive to the end now under contemplation. It may properly be conjoined with the daily matutinal washing, only requiring that the whole body be either immersed in the water, or that those parts not easily covered be well splashed over. To obtain the refreshing effects of cold water without the shock, the temperature of the water used should not fall more than ten degrees below that of the surrounding air in summer, and in winter it should equal, or better, rise ten degrees above it. The

immersion in this may be sudden, and whilst the body is covered by the water it should be well rubbed with flannel or a sponge. From five to ten minutes, according to season, is long enough to remain in the bath, and then the friction should commence immediately. When the skin has been made warm, not before, dressing may be proceeded with.

2. *Cool Bath.*—The bath now just described is nearly allied to the cool bath, and has the same physiological effects. As a luxury in hot weather, one, too, perfectly safe and promotive of health, nothing can exceed the cool bath. The temperature, I have said, varies from 65° to 82°, and to enjoy the full effects of it, the degree of temperature must be pretty accurately adjusted to the season. To enjoy this bath, the old directions of Galen respecting cold bathing should be adopted—viz., to rub the surface of the body gently for a few minutes before immersion. In this way the pleasure of the contrast from heat to cold will be enhanced, whilst all danger of prolonged stay in the bath will be removed.

No very appreciable reaction follows the bath thus used. The chief result is the abstraction of heat from the body, and this is done so gradually as not to give rise to chill afterwards, provided moderate rubbing be used to recall the blood to the surface. A slight languor succeeds the drying of the person, provocative of rest and repose. After a time the refreshment of the powers is felt, and renewed vigour of body and mind is experienced.

Tepid Bathing.—The cool bath may be converted into a tepid one, and used in the same way, with the same results, when the weather is very cold, or when the powers of the body are depressed, or in the case of delicate women and children. After severe exercise in the heat, or in the rain, when the joints are stiffening and the body feels chilly, a rapid

tepid bath, or simply washing of the whole surface, is extremely refreshing, and in some cases the only safe bath. What sportsman has not experienced the great comfort afforded by a warm foot-bath, with tepid sponging, after a hard day's walk over the sun-baked earth in the shooting season? Beyond such comforts as these, the tepid bath produces no valuable effects.

3. *Warm Bath.*—The immediate objects for which the warm bath is used are to allay pain, to soothe irritation, or to draw the blood from the inward parts towards the surface of the body, thereby promoting perspiration. Here everything points towards a sedative effect: excitement or stimulation, if it be at all present, is only so at the commencement of the bath, to be quickly succeeded by a pleasing quietude and languor. It follows that the robust and healthy have no occasion for the warm bath, except under peculiar circumstances. After great fatigue, injury, sprain, or over-tension of the muscles, a warm bath is the proper remedy. Also after exposure to the drying effects of travel, particularly in an east wind, warm bathing will act as the best restorative. The first access of a cold may also often be successfully treated by a prolonged warm bath. Persons whose skins are naturally harsh and dry, or which have become so by long confinement in inactivity by illness, are also greatly benefited by a series of warm baths. In short, as a remedial agent to restore the balance of the circulation when disturbed, to open the pores of the skin contracted by cold or disease, to relieve the congestion of blood in any organ which has been over-worked, and finally, to allay irritation of mind, arising from whatever cause, the warm bath is a most efficient and valuable agent.

The time for remaining in the bath must be

regulated by the effect which is sought to be produced; but from 20 to 40 minutes will be found to embrace the two extremes. When taken to refresh the tired body, or soothe the irritability of the nervous system, the bath should be taken some little while before the time for sleep. It should precede, not follow a meal, if taken early in the day, and the surface must be carefully protected from cold, as no active exercise should follow.

An occasional warm bath is refreshing and salutary, but its systematic use is not to be recommended, although many persons of inactive temperament and dry skin may take them once a week with advantage. Old people, and those whose powers of reaction are feeble, may use the warm bath more frequently than the robust, and they are, in these cases, supposed to be highly conducive to the continuance of health and the prolongation of life.

4. *Hot Baths.*—Hot baths must be classed with those of the other extreme of temperature, as to be used medicinally rather than as simple hygienic agents. They should never be taken without a correct knowledge of the state of the bodily functions, and of the temperament of the individual. The direct effect of the hot bath is great excitement and stimulation of the circulation and nervous system. The blood courses through the body with increased speed, which if long continued may exhaust the heart's action, and so produce fainting from diminished flow of blood to the brain. It is useful in effecting a change in the condition of parts below the skin, as the large viscera of the chest and abdomen. The pulse should be carefully watched whilst in the bath, and on the first approach to flagging the person should at once remove from it. Exercise in the open air does not seem to be injurious after taking the hot bath; in fact, there is so

much determination of blood to the skin, as to enable it to resist the effects of cold for a considerable period.

5. *Other Kinds of Baths.*—Shower, vapour, medicated, hot air (or Turkish), sand baths, packing, &c., are all baths which, so far as they have any utility, tend to produce some special effect. The first, when used very mildly, may be substituted for the cold sponge bath. Vapour and hot air can only be used in conformity with the directions of the physician. The Turkish bath is an agent most powerful for good when used occasionally with a view to modify the actions of some of the organs of the body; but its indiscriminate or rash use may be productive of very severe, nay, even of fatal effects.

SEA-BATHING.—This, the king of baths, need not detain us long. It is not likely to be undertaken by any but the comparatively strong, except under medical advice; and the season of the year which pleasure and the customs of society have devoted to it—viz., the latter part of summer and early autumn—is of all others the most appropriate. Sea-bathing is used altogether as a stimulant. If it do not act as such, it should be at once abandoned. As the stimulating effect is due in a greater degree to the first shock than to the effects of the saline impregnation of the water, none should use it who cannot bear the shock which the sudden plunge produces. Invalids and aged persons, and those of a very nervous temperament, had better content themselves with a salt-water bath at home, or in the bathing establishment, than venture into the sea; at all events, until they have become accustomed to the revulsion caused by cold water.

The proper method of taking a sea-bath is that which will ensure the greatest reactionary effect from the *first* shock. Immediately on plunging into

the water, which need not, except in persons of full habit, cover the head, which can be wetted afterwards, brisk motion of some kind should be used. Those who can swim should do so; those who cannot, and ladies and children, should make as much exertion of the limbs as possible, or rub the body with their hands. Very soon after the first immersion, a reaction takes place, and the giddiness and breathlessness of the first moments are succeeded by a universal glow, a lightness and buoyancy of the limbs, and a brave and joyous feeling of the mind. So long as these sensations remain, the bather may safely enjoy the sport of battling with the waves, but on the first hint of their subsidence, he should leave the water, and not expose himself to that *second* depression which is caused by the abstraction of too much of the heat of the body, and consequent failure of the vital force. The strong should not neglect this rule; otherwise, instead of the vivacity of mind and springy lithesomeness of the body which ought to be the permanent effects of the bath, languor, sleepiness, and bodily weariness will hang about them for the remainder of the day, and perhaps for a longer period. The delicate, and particularly those who are recovering from illness, should remain a still shorter time, and remove from the bath *as soon as the glow arrives;* or, if that be not felt at all, then after *one* plunge. These latter should on no account dress themselves until they have, by friction with a rough towel or the brush, restored the circulation to the skin, which ought to become of the colour of a freshly boiled lobster. Let no one fear that this rubbing will make the skin permanently red or coarse: far otherwise; constant friction after bathing, rather, it must be confessed, with pure than with salt water, produces the most dazzling whiteness, by clearing the circulation of

effete matter, and leaves a satin-like surface of the most delicate and elastic texture.

There is some difference of opinion as to the proper time of day to take the sea-bath. Practically, it is very much regulated by the time at which the tide serves, at least as regards those who are dependent upon the bathing-machines. Men who wish really to enjoy the excitement which a fierce battle with the waves can give, will eschew the well-frequented beach and the prying eyes of the curious and prurient, and seek some bold rocky headland where one plunge will carry them safely down amongst the fishes. To the strong bather, then, it matters not much at what time he takes the water. Before breakfast is a favourite time, and the shock to the system is then the greatest, because the water is coldest and the system the most relaxed. But to all who do not come within this class of A 1 in constitutional powers, the forenoon is the best period for sea-bathing. The system is then fortified by breakfast, and should be braced and warmed by half-an-hour's brisk walk before going into the water. When this cannot be done, and indeed in all cases where the shock is severely felt, the advice of Galen already quoted, and which the author has found of the greatest service, is to *rub the surface all over before going into the water until it is in a complete glow.* Those who have not practised this manœuvre have no idea of the heightened pleasure which the plunge into the cold water then gives, and a free action of the skin having been already excited, is easily continued after leaving the bath.

The cold sea-bath should be taken, if possible, when the sun is shining, when the water has been warmed by contact with the heated sands, and never during the digestion of the principal meal, or late in the evening. I am aware that there is nothing very new in these

directions for the use of the sea-bath, but they have the advantage of being founded upon the best established laws of physiology, and cannot be too much insisted upon by men of my profession. Much disappointment often results to persons of not very strong powers by setting about their sea-bathing in an imprudent manner, or using it too freely. It must be owned that the very decided effects of a cold bath taken at intervals are by no means maintained in their full force by its constant repetition. Indeed, the system appears to accommodate itself to the operation, and so, at last, gets to receive the shock with stoical indifference.

In many cases, particularly those of persons who have never used sea-bathing, it is best to begin with a warm or tepid salt-water bath, proceeding by degrees to the cold, in-doors, and then to the open sea.

At what age is it prudent to use cold sea-bathing? Our knowledge of the vigour of the circulation at different periods of life seems to inform us that it is not safe, as a rule, for very young children. Before the age of seven, it should be used with the greatest caution. After fifty-five years of age, the vigour of the circulation begins, in many people, to abate. The heart and great vessels are often at that age invaded by changes which diminish their efficient action, and therefore disable them from effecting a proper amount of reaction after the shock of immersion. It appears to me that young men and females obtain the highest results from sea-bathing: the former because their circulatory powers are the most vigorous, and the latter because, the body being partially covered, they feel the shock of immersion less strongly, and because they take the bath less frequently and commit fewer indiscretions while in it, than the other sex.

ON SLEEP.

Causes of Sleep.—The principle upon which all organized beings upon this globe operate, is that of alternate activity and repose. Light is the great stimulant to vital motion, and it is under its influence that the functions of both animals and plants are carried on in their highest intensity; and upon its withdrawal, that they sink into comparative or entire inaction. *Periodicity*, in some form or other, pervades most of the functions of life. These periods form their cycle in hours, days, months, or years. All this is in entire accord with what we observe in the physical world;—in the rotation of the planets, in the alternation of heat and cold, of light and darkness, of formation and destruction.

Not only is this so as regards the economy of this earth, but we are entitled to conclude that, if there be any life, any organized beings, subsisting in the celestial spheres, the same law of periodically returning activity and repose dominates over their operations also. Astronomers tell us that, in their elementary constituents, the other members of the solar system closely resemble our own globe. We know that day and night, winter and summer, cold and heat, are there; analogy bids us conclude that sleeping and waking will also be found in their train. In fact, it is only in the regions of perpetual light, where the ethereal spirit needs no rest to recreate the gross particles of an earthly tenement, that we can conceive of a state of perpetual wakefulness and activity.

If these reflections satisfy us as to the *final cause*, we have still to seek for the immediate, or proximate, as well as for the predisposing causes of sleep. Much ingenuity of reasoning has been wasted in trying to ascertain *why* the vital powers should flag, and the mind be thrown "out of gear" with such unerring regularity. All life is exhausting. The amount of

energy, of capacity for life, bound up in the embryonic germ from which any animated being springs, expends itself in development, in performing its allotted functions, in propagating its species, and in the provision of the sustenance and future welfare of its offspring. It is perpetually being recruited, and, so to speak, *recreated*, by food, and by the operation of air, light, and heat,—the great natural stimuli to life.

Whilst thus maintaining its individual existence, and taking thought for the continuance of the species, the organism steadily, though imperceptibly, loses some of its innate force, which, in the course of each diurnal period, runs down like the weight of a clock, or uncoils like the spring of a watch. The sleeping animal is not dead, like the stopped watch; nor can sleep be likened to death except metaphorically: the functions are partly in abeyance, it is true, but they possess the power of rousing themselves again to activity, when the period for it returns, without the application to them of any fresh or sudden stimulus.

The truth is, that fresh force, nervous and muscular, accumulates during sleep; and we wake up in the morning with a stock of pent-up energy sufficient for the waste of the next waking period; just as the newly wound-up watch, saving the imperceptible loss of wear and tear, is as good to-day as it was yesterday.

After all, there is, *à priori*, no physiological reason for sleep. If we take it to be owing to a diminished nutrition of the brain, from which deficiency of vital force ensues, there is no reason why nutrition should not proceed with unabated energy during the whole twenty-four hours; nor, even supposing nutrition to be diminished, that total unconsciousness should supervene.

The withdrawal of light, which appears to be one main promoter of sleep, is not a necessary one; for in high arctic regions, where the sun remains above the horizon for many weeks together, sleep is equally

necessary, and, it is presumed, equally sound, as in lower latitudes. A recent traveller in Norway expresses the perplexity that his party were frequently in, owing to the want of the accustomed relation between sleep and darkness. It was curious, he observes, to see the birds sitting on the bushes fast asleep in broad daylight.

The proximate and predisposing causes of sleep, then, are not much more obvious than are its final causes. We must conclude that they lie deep down amongst those beautiful and orderly adaptations of natural phenomena to each other which are always working together for the happiness of sentient beings.

Physiologists are entirely agreed that there is a diminution of the energy of all the functions during the natural period of sleep. The pulse and respiration become slower, the heat of the body falls, and requires extra support from clothing, or a warmer air; the carbonic acid discharged from the lungs is diminished in quantity, and so, perhaps, is the insensible transpiration through the skin.

There is no doubt but that the gradual diminution of the vital force in its various manifestations, as the day proceeds, at length reaches a point below which the organs will no longer respond to their accustomed stimuli with a sufficient amount of energy for the due performance of their functions; and that sleep is appointed to renovate them by an accumulation in their substance of nutrient matter, whose forces are new and intact. But there is a great difference between the condition, during sleep, of those organs which minister to sensation and motion, and those which govern the vital motions of the heart and lungs. Sensation and perception of outward things, and to a great extent of inward feelings, are, in sound sleep, in total abeyance; whilst the functions of respiration, circulation, and secretion, are only

reduced in their amount of activity, not altered in their character, nor seriously interrupted.

Quantity of Sleep.—There are few subjects connected with health upon which so much difference of opinion has been expressed as that regarding the proper quantity of sleep. Not only has every individual, from constitutional temperament, a standard of his own, but habit is in this matter pre-eminently a second nature. Nevertheless, there must be a standard of quantity normal to the great majority of people. This has been very variously stated—six, seven, eight, and even nine or ten hours' sleep have each had their advocates. Some of these have given their adhesion to their favourite number upon merely fanciful grounds; as King Alfred, by making three eights of the 24 hours—eight to work, eight to play and recreation, and eight to sleep. Others divide their time into four equal parts. One to sleep, one to study, one to the world, and one to the family and to God. Sir W. Jones improves upon this, and, in his usual sweet and pious vein, gives

> "Six hours to law, to soothing slumber seven,
> Ten to the world, and all to Heaven."

But it is the nature of a man's employment which must determine the quantity of sleep. Those occupations which are conducted in the open air are not only most conducive to sleep, but also require the largest quantity of it. The day-labourer goes to bed at nine, and sleeps soundly till five or six. His repose is made sound by the severity of his toil, and the great amount of change which goes on in his system, from muscular exertion, demanding a corresponding degree of functional repose. The sedentary citizen, on the other hand, making use of but little bodily exertion, and changing the tissues of his body more slowly, both sleeps less, and that less soundly, than the country-

man. Six or seven hours' sleep often suffices for the artisan, shopman, and domestic servants. The more leisured classes, and the luxurious, indulge in a longer term of repose; but it is more broken and disturbed, and therefore less refreshing, than that of more active persons. The average quantity of sleep, I think, as applicable to the wants of the majority of grown-up persons, may be stated as eight hours. Less than this does not suffice to thoroughly recruit the wasted powers of very actively employed people; and more can only be required in exceptional cases. Children should be allowed a larger quantity than adults, in proportion to their youth. Up to six or seven years of age they require, in winter, twelve hours; in summer an hour less. From this age to fourteen or sixteen, nine or ten hours may be allowed; and so gradually diminishing to the eight hours, as above stated. Women are supposed to require more sleep than men. This is only partly true. Those who have the cares of a family, perhaps the duties of childbearing and nursing, in addition to the daily routine of the household to undergo, may take an hour extra with advantage; but ladies in society, and young females employed in in-door labour, frequently take less sleep than men.*

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* There are many exceptions to this rule. Some delicate and nervously constituted individuals require as much as ten hours' rest to fully recruit their powers. On the other side, history records that some of the most eminent men the world has ever seen, famous for the unceasing restlessness of their characters, and the indomitable energy of their minds, have been very sparing sleepers. Amongst generals, Frederick the Second, Napoleon, and the Duke of Wellington are prominent examples of this class; whilst John Hunter and Wesley, amongst studious and literary men, slept but five or six hours out of the twenty-four. Indeed, it is recorded that a French gentleman, of great attainments and powerful intellect, only passed *one quarter of an hour nightly in sleep.* In this case there was doubtless some morbid condition of the brain and nervous system.

Work of the brain, especially study, is more exhausting to the vital powers than manual labour, and, to be successfully conducted, requires a large amount of sound sleep. There is great variation, however, in this respect amongst literary men, and others whose minds are on the stretch for a great many hours daily. Such persons should *cultivate* sleep; when hard-worked, snatching an hour whenever it can be got. It is astonishing the relief which even ten minutes' complete oblivion will give to the jaded mind after any great strain upon it. The same is not true with regard to mere physical fatigue. In this case, sleep should be deferred until the regular period for rest; and then, if required, an extra quantity may be taken; a short sleep only stiffens the joints and causes great languor and feverishness. Persons recovering from long or severe illness must be placed in the same category with young and growing people, and for the same reason. The nutritive powers assume an increased activity to supply the waste of the body caused by disease, and this is entirely favourable to the growth of young persons. From eight to ten, or even more, hours' sleep are often demanded under these circumstances.

Old people are said to require, and often to take, less sleep than the middle-aged. This also is only partly true. Many old men sleep during a large portion of their time, and, in fact, their long endurance seems to depend much upon the quantity of sleep they are able to procure.

A larger allowance of sleep seems to be required in winter than in summer, but it is difficult to separate the effects of habit from the requirements of nature in this particular. There is often more rest taken in hot weather in the daytime, which, even without sleep, refreshes and saves the vital forces.

Persons labouring under chronic disease of a pain-

ful or wearing character should cultivate sleep, as during the rest which the nervous system obtains in it, nutrition will go ou with better effect, and the brain and nerves be allowed a longer period to recover their tone.

Grief demands the kind offices of sleep. "Nature's sweet restorer" is never so salutary and soothing as when great and sudden grief has exhausted the whole powers of the frame. "When sorrow sleepeth, wake it not."

The proper Time for Sleep.—Those who turn night into day justify their proceeding by declaring that it signifies not at what time sleep is taken so that the system gets as much as it requires. All Nature, however, testifies agaiust them. The exact correspondence of the activity of vegctation with the quantity of light, and the manner in which the infcrior animals follow the course of the sun in their habits of sleeping and waking, prove that there is a natural and necessary connexion between daylight and work, and darkness and slccp—whilst those who retire early to rcst, although they may also rise beforc it is light, do not suffer for the practice; the custom of society which, in the long days especially, throws the greater part of the slccp into the morning light, must be, and is found to be, most destructive to sound health. It is truc that in wintcr there is seldom anything to call up any but those cngaged in manual labour, beforc seven or even eight o'clock, thus allowing till midnight for society, reading, or study. But in summer, thcre is evcry reason for retiring to rest as soon as complcte darkness prevails. One of them is that the addition of artificial light for any long time to the fatiguc caused by the bright light of day is vcry trying to the sight. How charming is the carly morning in thc summer scason! How the spirits rise, and the body craves for action when stimulated

by the fresh sharp air of that period of the day! Who that has ever been compelled to rise very early, say at five or six o'clock, on a bright summer's morning, but has wished he could always do the same thing; and how many virtuous resolves are made to begin to do so—alas! how soon to be consigned to the limbo of so many other good resolutions.

But there are many occasions in which sleep by day is allowable, and even salutary. During a long and tedious journey, when there is not sufficient amusement to break the tedium of travel, sleep is often a valuable resource. This applies especially to railway travelling, in which the eye is fatigued by rapidly passing objects, and the body much shaken and disturbed. Sleep may also safely be indulged in in very hot and sultry weather, especially by the young and the very old. In all these cases care must be taken not to expose the body to draughts.

Sleep after Dinner.—The propriety of sleeping after dinner has been long a moot point. Its opponents and favourers have alternately had the best of the contest, which, like so many others upon kindred subjects, arise from each champion persisting in looking upon the question from one point of view only, and that point an entirely different one to that from which his antagonist sees it. The propriety of sleeping after dinner must be judged of by its merits, and these can only be estimated by paying due regard to the age, temperament, state of health, and amount of work done by the individual. To these may also be added climate, season, and state of the atmosphere.

There is a sort of prejudice in these latitudes against the noontide siesta which prevails so generally throughout the south of Europe. It is looked upon as a lazy habit, growing out of over-indulgence in the pleasures of the table. No doubt many persons are open to this judgment; but, on the other hand, there

are many whom constitutional debility renders very inert after a full meal, and these require this rest to recruit the powers of the nervous system. Very young children, it is to be observed, absolutely require rest after food; indeed it is impossible to prevent their falling asleep so soon as the appetite is satisfied. The same is true with regard to old and feeble people, and those who are debilitated by disease or over-exertion.

All these circumstances point to the fact that there are many cases in which Nature seems to call for rest after taking food, and herein arises much of the difference of opinion which exists upon the subject. The young, the delicate, and sickly, particularly those of weak digestive powers, and the very old, claim the privilege, and declare that they cannot well do without it. On the other hand, the hearty and robust who, if they suffer from indigestion at all, it is that of repletion—find by experience that indulging in sleep after dinner invariably leaves them heavy and disturbed for the remainder of the day. Moreover, much depends upon the circumstances of the case. A person who is actively employed the whole of the day, going from breakfast till dinner, at six or seven, with nothing more than a biscuit, or, at most, a sandwich and glass of wine between, so exhausts his nervous energy that the stomach has great difficulty in digesting such a meal as the system requires, and therefore absorbs all the blood and all the nerve-force which it can lay its hands on, to enable it to get through its work; so that, as in this case, it is by no means the full-blooded, apoplectic-looking man, who indulges in after-dinner sleep, but much more frequently it is the thin, nervous, and energetic man of business, who has done more work than is good for him, and eaten more food at one time than he can well digest. Here the proper remedy for the evil

would be to divide the food usually taken at dinner into two meals, and to make either a light dinner, or substantial luncheon, at one or two o'clock, resuming business directly afterwards. If this were done, the evening meal would be a much less heavy affair, and, followed by a cup of good black tea an hour or two afterwards, would leave the system light and vigorous enough to enjoy society, or study, during a moderately long evening. An hour's perfect rest after a late dinner, whether heavy or light, should always be secured, and if it be wished to refrain from sleep, an amusing book and a not too easy chair may be resorted to.

Hot weather, like hot climate, conduces to sleepiness after dinner, particularly if this be taken in the middle of the day. The best way of defeating this tendency is to take a very light meal at noon, resting a little after it, and then taking a cup of tea before the more substantial meal—whether it be called dinner or supper—of the evening. The proper division of the day as regards meals has been, however, already discussed; and we are here only concerned how to arrange them so as to avoid the proclivity to sleep after dinner, when such a thing is undesirable.

We may sum up what we have said as to indulgence in an after-dinner nap, to the following effect:—We know that it is practised almost universally in southern Europe: after an early noon-day meal, the whole population retires to rest, all business is suspended, and the silence of night reigns around. As the heat declines, and evening's refreshing breezes begin to be felt, all is life again. Exercise, pleasure, and business resume their sway. No evil result follows this practice, which is also that of the inferior animals, who do not sleep because they have eaten too much, but because digestion is active, and their

brains inactive. Many delicate persons of feeble digestive powers seem to require absolute rest of body and of mind, in order that their digestion may not be interfered with by the activity of any other function. Habit too, with many, plays the part of second nature ; and the forty winks, the momentary oblivion, become essential to post-prandial comfort. The outcry against sleeping after dinner which we hear in this country arose in a past age, when persons were accustomed to eat, and certainly to drink, far more immoderately than they now do. My dictum, therefore, is, that where relief rather than discomfort is found to follow a moderate indulgence of this habit, it may safely and properly be practised; also in the cases already mentioned, and during hot weather; but to those of full habit, and of strong digestion, it is better to be contended against and overcome by the proceeding which I have here pointed out.

Provisions for securing Healthy Sleep. — The deriders of science as applied to the every-day occupations of domestic life are accustomed to make merry over the oscillations which the dicta of the *cognoscenti* have undergone, frequently passing from one extreme to the other. In bygone times, our ancestors were in the habit of ensconcing themselves in their lofty four-posters with thick damask curtains clothing them in on every side. The windows, also, being thickly draped, and the doors carefully closed, they sank into oblivion, lost in the deep sinuosities of an enormous feather-bed. Afterwards came a reaction. The good old souls were supposed to have poisoned themselves (slowly, indeed, if the great ages to which they lived are taken into account) in the fumes arising from their own bodies, and the new sanitarians set about to exchange the grand old four-poster for a modern low camp or Arabian bedstead,

denuded of all curtains, and to undrape the windows and admit a free circulation of air by means, perhaps, of open windows all night. The luxurious feather-bed was cast away, and a single thin mattress of horsehair substituted for it. Surely, may the derider say, both of these customs cannot be right. If it was good to sleep in an atmosphere of carbonic acid, carefully preserved around the body by feathers, damask curtains, and closed windows, the opposite plan of allowing free access of fresh air to the sleeping body, and removing every accessory to warmth and stillness, must be the very worst that can be devised.

How is this antagonism between the time-honoured customs of our forefathers and the practice of modern radical sanitary reformers to be reconciled? Upon what principles shall we presume to decide which party is wrong and which right in the controversy? Simply, I opine, by observing the physiological phenomena of sleep, and the manner in which the frame is operated upon by the ordinary vital stimuli during the period of rest.

We know that the circulation is diminished in force and frequency during sleep; that respiration is slower, secretion less active. That of the skin, nevertheless, is kept in activity by the warm stratum of air in contact with it, and which the bedclothes maintain. Less animal heat is generated, and the power of resisting cold is diminished. Moreover, to promote the accession of sleep, the organs must be withdrawn to a great extent from their accustomed stimuli. The light must be excluded from acting upon the tired retina of the eye; the ear must be preserved from the impact of sounds, except such as are of a low monotonous character; the cold air must no longer blow upon the face and rush into the lungs to excite the circulation, and the warmth of the skin must be preserved by an irremovable

layer of warm air in contact with it. How, then, do the removal of curtains from bed or windows, opening the latter to admit light, air, and sound, and the frequent removal of the stratum of air in contact with the body which a current effects, comport with these physiological requirements for sound sleep? I think in no way. Indeed, some very interesting observations which were recently communicated to the French Academy by M. Delbruck, go far to discredit the recent fashionable theories regarding the proper management of sleeping apartments altogether. Considering that less oxygen is consumed by the sleeping than by the waking body, he concludes that the transformation of tissue, upon which animal heat greatly depends, is reduced in extent during sleep, so that the maintenance of sufficient warmth by artificial means is indicated. Not only is this so, but looking at the habits of animals during sleep, we find that provision is made not only to secure warmth, but *to retain to some extent the carbonic acid gas expired in the air which they breathe.* For example: most birds crowd together when roosting, and bury their heads beneath their wings in such a manner as must prevent the free access of air to their lungs. Pigs and other animals adopt much the same plan of going to rest; for, by crowding together and half burying themselves in litter, they do all in their power to retain about their bodies both the animal warmth and the expired air. Even human beings instinctively roll themselves up when seeking sleep. The schoolboy, when he cannot sleep for the cold, gets under the bedclothes, and all young animals sleep best when almost entirely covered up from the air. So our old-fashioned people had the analogy of the lower animals in their favour, at all events, when they surrounded their beds with thick hangings to keep in the warmth, and to

protect the surface of the body from draughts of cold air.

What now can be the object of this instinct? Is it not to secure the tired body from the *excitement* of too cold and too fresh an atmosphere? Startling as this may appear, there is no escape from the conclusion. Even a certain excess of carbonic acid in the air respired during sleep seems to be provided for in this arrangement of nature. And if so, it must serve some useful purpose. There is no escape. We dare not suppose that the instinct which nature has implanted in these animals is intended to mislead them or us. Carbonic acid in the atmosphere is known to produce sleepiness, and when in great excess, stupor. The provision here made to retain a portion of it in close proximity to the lungs, would seem to be intended to lull the brain and nervous system to rest, by offering some slight embarrassment to the respiration, which always becomes slower and deeper during sleep. Were our grandmothers right, then, in their four-posters and damask curtains? It would seem so. Yet it does not follow that we are to imitate their example to the full extent, now that all draughts of air can be excluded by means of well-fitting doors and windows.

Fallacy of some Modern Ideas.—If these views have their origin in nature's laws, what shall we say of the present mania for open windows in bedrooms all night, free admission of light, and the use of materials for bedding defective in the power of retaining the heat of the body? Miss Nightingale and her followers (how often followers mistake and caricature the intentions of their leaders!) say, open your windows, remove the chimney-board, strip the curtains from your bed, clothe it lightly, and let in all the oxygen you can. But from what source did Miss Nightingale derive these principles, and to what

class of dwellings does she seek to apply them? In a hot and insalubrious climate, amongst the pestilential exhalations from thousands of wounded and diseased bodies, crowded together in the reeking hospitals of Scutari? Or from observation made upon the effects of sleeping in the well-aired apartments of the wealthy, and of the comfortable middle classes of this country? No answer need be given. The admirable directions of an acute observer and most energetic and decisive actor in the noble work of charity have been most foolishly travestied by the unthinking public; and truth compels me to add, by not a few of the members of the medical profession, who ought to have known better. Miss Nightingale would scarcely council the letting in of cold and damp night air to rooms which are not crowded with sleepers, and where scrupulous cleanliness is observed, both as regards the body itself and the bed-clothing on which it lies. She would not discard the feather-bed, but she directs that *all* bedding, blankets, &c., should be periodically and frequently aired and dried to expel the animal matter which they have imbibed from the person. She says, remove the secretions, or so close the vessels containing them that there can be no exhalations (a thing highly necessary to be done where numbers sleep in the same apartment). Good. Do all this, and I will venture to affirm that a moderately soft and warm bed, sufficient clothing, a rather warm than cold air, perfect stillness, absence of draught, and of light, will be far more conducive to sound and healthy sleep than the opposite practice; always presuming that the room has been well ventilated during the best part of the day, and closed before the evening damps fall, as already directed under the head of Ventilation.

With regard to the amount of warmth required to be furnished by the bedding and bedclothes, there is

great difference in the feelings of individuals. Whilst weight of clothing is oppressive, and prevents sleep with some, others are cold and uncomfortable without it. As regards the bed itself, I think no safer practice can be pursued than that of placing a moderately soft feather-bed *upon* a hair mattress in winter, and under it in summer.

In apartments which are sufficiently large for the number of occupants, no air should be admitted at night except what enters through the chimney or the chinks in the doors and windows, *except in warm weather*. But to those which are more crowded, air may be allowed to enter through an open door communicating with the body of the house, or by the window in dry weather; always remembering that the body requires less oxygen by night than during the waking hours.

Where a large number of individuals are crowded together in one apartment, whatever its size, as in schools, hospitals, &c., a modification of these directions will be necessary. A gentle movement of the air through the chamber should be secured for the purpose of removing the exhalations as they arise. In winter, this is best effected by placing a fire in the room to which air can gain access by open doors; and in summer, by leaving the windows open, *at top*, all night.

In connexion with the ventilation of sleeping apartments, I have already spoken of the value of fires in rooms occupied by invalids and old people. There is no doubt but that in cold climates, and very severe weather in our own country, numbers of aged people perish in their beds from the low temperature of their rooms. What can be more foolish than for delicate people, in winter, to go from a warm sitting-room to pass the night in an atmosphere but a few degrees, if at all, warmer than that of the outer

air? From this cause many delicate persons, especially those who have a tendency to bronchial complaints, pass the night between uncomfortable chills and coughing, never dreaming that they are in very nearly the same situation as a person who should take a lot of rugs, and wrapping himself in them, lie down in the open air, breathing all night a cold and dewy atmosphere.

The condition of the body exercises a great influence, good or evil, upon the chances of obtaining sound sleep. All the functions should be in repose, as much as possible. All excitement of the circulation, or of the sentient and mental powers, should be carefully avoided previous to going to rest. The stomach should have completed, or nearly completed, digestion. Yet too long a time since the last food was taken should not be allowed to elapse before bedtime, or the want of sustenance in the system will cause, especially in weakly persons, a feeling of exhaustion and sinking which is antagonistic to sleep. Many persons rest better after taking a little supper a short time before going to bed. A cup of cocoa with bread-and-butter, or a cupful of arrowroot, with a table-spoonful of brandy in it, will answer this purpose.

It is unnecessary to descant upon the condition of mind most conducive to sound sleep. As this happy state cannot always be secured, it is well to know what devices to have recourse to, in case of restlessness from mental causes. If the mind has been over-excited by amusement or important business, which generally have been performed in heated apartments, a stroll for half-an-hour or more in the cool air will be the best course. For those who cannot do this, recourse may be had to a total change of thought, such as may be procured by laying aside the object of study and taking an amusing book for a little while before seeking rest. Or, in the worst cases,

we must try to read ourselves to sleep in bed. If all will not do, it is better to rise and set about some occupation, leaving the hope of rest until the following night, when the utterly-jaded frame will succumb to the overwhelming necessity for sleep. If sleep be prevented by an over-distended stomach, with flatulence, a common thing after late dinners, some of the common remedies for this state must be taken before retiring to bed. After all, the proper way of obtaining the blessing of sound sleep is to attend to the teachings of Nature as regards the management of the health generally, instead of depending upon artificial means of whatever kind. Foremost amongst these must be placed early rising. However disagreeable it may prove to attempt to break through the habit of years, perhaps of a long life, perseverance will, in almost every case, be rewarded by the attainment of greater soundness of sleep, and, as a consequence, with feelings of increased elasticity of body and buoyancy of mind unknown before. Regularity in the hours of meals and of retiring to rest, and also in the quantity of food taken in the twenty-four hours, is the second highest means of effecting this end. Thirdly, plenty of exercise in the open air, which, in London, may safely be taken late in the evening, after the excitement and heat of theatres and other crowded assemblies, and exposure to the noxious effluvia which arise in them. Lastly, the satisfaction of mind which arises from the consciousness of having honestly and honourably performed every appointed duty of the past day—never putting off till to-morrow what can be done to-day—must be reckoned not least in the list; for it is the most blessed of all, insuring, as it does, the approbation of our own conscience, and the tender fatherly and *motherly* care of the All-Beneficent One, "for *so* He giveth His beloved sleep."

CHAPTER VII.

HEALTH OF MIND.

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SECTION I. INTELLECTUAL HEALTH.

To have and to know, these are the fundamental desires of intelligent beings. The acquisition of food and bodily comforts gratifies the animal instincts: and curiosity, the acquisitiveness of the mind, leads them to seek knowledge for the gratification of their mental and moral instincts. "The corporeal appetency," says Dr. Chalmers, "seeks for food as its terminating object, without regard to its ulterior effect in sustaining life. The mental appetency seeks for knowledge, the food of the mind, as its terminating object, without regard to its ulterior benefits, both in the guidance of life, and the endless multiplication of its enjoyments."

Life is an arena upon which men have the opportunity of displaying their accomplishments, corporeal and intellectual. In the Gymnasia of old, they wrestled together with the body for the purpose of displaying their physical agility and strength; and with the mind in contesting the palm awarded to genius or mental industry. The whole extent of natural knowledge represents the wealth which may be acquired, and the hoards which may be laid up

for the use of the labourer or his successors are only limited by the capacity of the human faculties.

Knowledge of Objects.—To satisfy the craving of the mind for objective knowledge, it is evident that the senses and perceptive faculties ought to be early educated to observe and to distinguish. Yet how little is this principle recognised in the education of the young! In the first years of life, indeed, the acquisition of a knowledge of objects is all that the infant can accomplish. On beginning school, however, his attention is almost completely withdrawn from natural objects. He enters upon a totally different world from that in which he moved before; one in whieh subjective knowledge takes the place of the objective. Grammar and languages, mathematics and other abstract studies, occupy all his attention; and his knowledge of natural objects and proeesses remains, at the time of leaving school, pretty much as it was on entering it. The games of play are well enough adapted for bringing out the physical powers, and some of the lower moral qualities, but the curiosity is never aroused, and there are literally no opportunities for its gratification. The case of girls is still worse. In their staid and formal walks they see nothing of the *individuality* of nature; the stones, the flowers, the birds, the insects, are all unknown to them; for even when taking a country walk, loitering to collect and observe would be a breach of that funereal decorum which seems to be the essence of young ladies' exercise.

There is no doubt that the reason why English people, with all their taste for country pursuits, are generally uninterested in the study of natural history, is the neglect of object-culture in early years. The eyes are not taught to see, the ears to hear, nor the sense of touch to feel. The consequence is that, in after life, nothing is so common as to find educated

people unable to describe the qualities of the commonest natural objects with precision, or even to detail with accuracy an event which has passed under their own observation.

The amount of intellectual gratification which is thus placed for ever beyond the reach of thousands of educated persons is very great. It can only be known by those who have endeavoured, in later life, to make up for the shortcomings, in this respect, of their younger days: but it seldom happens that a taste for a knowledge of natural objects is acquired when the cultivation of it has been neglected in early youth. In the matter of gardening, for instance, no one ever takes kindly to it who showed no love for it in youth.

Effects of its Neglect.—How many men of business there are who, engaged in engrossing affairs for perhaps eight or ten hours every day, find their leisure time hang heavily on their hands for want of some definite object of intellectual pursuit. The wealthy, indeed, may take to high farming or ornamental gardening, both of them delightful pursuits; but the poor clerk or shop-drudge has no such resource. A cultivation of the powers of observation, which the natural sciences at once call forth and exercise, would go far to bridge over this great gulf between the rich and the poor. It would form a bond of unity between them, by giving them thoughts in common, and providing a common platform where persons whose occupations are wholly diverse might meet upon mutually intelligible and mutually interesting ground. If this were the case, no social gathering, no friendly dinner-party, need be without the means of affording intellectual enjoyment and mutual sympathy to every individual in the assembly. A stimulus would thus be given to the acquisition and diffusion of knowledge, which

would go far to rival, in its good effects upon the community, the great gatherings of the devotees of science or social economy which are so marked a feature of modern civilization.

This exercise of the perceptive faculties by the study of natural science would also prove the best safeguard against the preponderating force of the imagination in the case of those persons who are inclined to allow that faculty to overbalance the judgment. Half the quackery, jugglery, and chicanery of the day owes its immunity from detection and exposure to the absence of the faculty of observation amongst so-called educated persons. The sad spectacles of credulity exhibited by the victims of the spirit-rapping and other impostors who, by concealed mechanical contrivances, pretend to play the part of overruling at will the laws of Nature, would be cured by even a tolerable smattering of the knowledge of the phenomena of natural science.

So also acquaintance with the realities of Nature would explain those phenomena of morbid sensation and perception which persons afflicted with them are credulous enough to believe, or dishonest enough to pretend to believe, to be the manifestations of supernatural powers or gifts. A competent knowledge of the unvarying sequence of natural phenomena, of the unerring relation of cause and effect, and of the impossibility that man can receive any communication from another world except by the special interposition of the Deity,* would make

* It is melancholy to find men of education, clergymen, for instance, setting down the exhibitions of the table-rapping impostors to the agency of the *devil.* Really this gentleman is very much maligned, for even his worst enemies can hardly so disparage his power, talents, or address, as to believe him capable of such miserably objectless and illogical vagaries as those which we have hitherto been told are the results of his adroitness. But perhaps he is only in his apprenticeship at this work, and is only now first

people ashamed of noticing the silly and shallow devices by which they are now imposed upon.

Balance of the Mental Powers.—I have hitherto spoken of intellectual exercise chiefly as a resource for pleasing occupation in the few hours which a busy age leaves unabsorbed by the more anxious cares of life.

It remains to say a word or two upon the management of the mental powers, so as to maintain a healthy balance of force amongst them for the purpose of preventing any of them from acquiring an undue preponderance over the rest. A well-balanced mind, in which all the moral and intellectual qualities have free play, none being overborne or obscured by the others, is always looked upon by moralists as the *beau idéal* of mental development, just as the nicely-rounded head, in which no bump protrudes beyond its allotted area, is the delight of the phrenologist. Yet it must be allowed that few great men have shown themselves of this complexion of mind. In the case of the heroes, martyrs, pioneers of science, and giants of literature, it has generally been by the overwhelming force of some of the faculties of the mind, unrestrained by those other which should qualify and correct their aberrations, that their greatness has been achieved. Genius is said to be akin to madness; and truly, in consequence of the want of power to restrain the intense application of the mind in one direction, until the subject of its contemplation acquires *for them* an importance which to other people seems to border

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trying his hand at disturbing the laws of physics to mystify us. Probably, when he and his above-ground assistants have become more adept in the use of their tools, we shall be favoured with some more interesting revelations than the trumpery guesses made by the ghosts of grandfathers and grandmothers, who cannot tell us where they have been nor what they have been doing all the time since they left this benighted world.

upon absurdity, great geniuses cannot be measured by the same moral standard as ordinary men.

This devotion of all the energies of mind and body to one object—whether it be ambition, knowledge, or social advancement—is in almost every case followed by deterioration of the health of both. It is just the same with the mental as with the bodily functions. Over-activity is followed by exhaustion of the organ which has been exercised by it, and this exhaustion extends itself by sympathy to all the rest.

The extreme division of employment amongst almost all classes tends to produce the evil alluded to; for, to secure the highest efficiency in some one pursuit, all the energies are constantly directed towards its attainment, and the other powers which are not required for this object are dwarfed by inaction. How seldom do we find persons in the middle ranks of life capable of readily forming a correct judgment upon any question out of the line in which their attention has been always exercised! And how certain such persons are to look upon large ideas and liberal propositions for the general advantage, if they proceed but a few steps beyond the beaten track, as visionary and unsound!

Danger of Over-concentration of Mind.—Probably in the present state of society it would be futile to attempt to do more than to counterbalance in some degree this concentrating tendency; but if a man cannot have two businesses with profit, he should have a business and a pursuit—I will not call it amusement. This other pursuit should be one which will complement the first by filling up the gaps left by it, and should be calculated as much as possible to call out the powers of the mind of an opposite nature to those which are required for the execution of the main business of life. Thus, if comparison, judgment, and close attention to the different

bearings of business matters form the principal occupation of the day, the imagination and taste should be called into exercise in the hours of relaxation by such studies as painting, music, or the lighter kinds of literature. In this way may be prevented that hardening of the character, that closing of the mind against everything which is not of a strictly utilitarian character, which pursuits of a purely intellectual nature are apt to produce. Oppositely, if the daily occupation be routine work, calling forth none of the higher faculties of the mind, but simply attention and industry, such studies as I have already described — natural history or physical science generally—will be the best complement, as at once occupying the faculty of observation and affording satisfaction to a healthy curiosity.

That this compromise between the mere uniformity of employments and experimental recreations is founded in Nature, is, I think, shown in the case of factory operatives. The work of most of these persons is so simple, yet requiring constant attention, that the mind revenges itself by a strong tendency towards natural history studies, gardening, and other similar recreations, which are the farthest removed from uniformity.

Exercise of the mind has been divided, by most authors, into active and passive; and this division has its advantages in reference to the amount of action or reaction which the brain is capable of undergoing. But with reference to the healthy balance of the mental powers by their own exertion, I believe that their separation into classes of diverse or opposite character, as attempted above, is the most practical and useful one. Passive exercise consists in reading, hearing discourses or lectures, and seeing spectacles, or dramatic representations. Here the mind is receptive only; but if the desire for knowledge be enter-

tained, and the mind be directed to reflect upon what is read, seen, or heard, then more or less activity is called forth, so as to come into the category of mental labour. It is particularly desirable to bear this in mind in the case of children and persons of little education or weak mental powers. When they have done their work, whether it be of the body or the mind, rest should be sought in amusement simply, and not in change of study. *Relaxation* of mind means a state in which sensation and perception lead to no cogitation.*

Quantity of Mental Exercise.—It is impossible to state anything with precision as to the *quantity* of mental exertion which is consistent with maintaining a healthy state of the brain. The powers possessed by different individuals vary to such an extent—from zero to boiling-point—that any rules in this direction would include as many exceptions as examples. I am of opinion, however, that if the average mind be

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* Many things at the present time tend to draw the working man towards this state of mind. Some years ago, when political excitement was rife and society much disturbed by the agitation of important questions affecting the welfare of the lower classes of people, all of that class who possessed any activity of mind became politicians; and at a time when cheap newspapers were rarer things than they are now, their minds were so worked upon by peripatetic demagogues, as to be completely withdrawn from simple amusements.

It was at such a time that the first mechanics' institutes were founded. They catered principally for the intellectual improvement of the operative; but as the times became more calm and great social questions settled, the motives for acquiring political knowledge passed away, the mechanic and the artisan turned again towards amusement. Working men's clubs, where games of skill, music, or dancing, could be engaged in, became the fashion, superseding the more pretentious institute. This I conceive to be one of the principal causes of the downfall of those institutions which were based upon the strictly educational programme; although this cause has seldom been adverted to when people have indulged in censure of the fickleness evinced by the operative classes in allowing their institutions to go to decay.

but gradually habituated to study or reflection, it may be brought to such a state of tonic force, that, by judiciously varying the kind of occupation, it will endure a full day's work without causing much exhaustion. When we hear of men like the Comte de Buffon composing for twelve or fourteen hours at a stretch, we must admit that the powers of the mind, as habitually exercised by most people, are still in their babyhood.

It is true that exercise of the mind in abstruse studies, or in business requiring great exercise of judgment, if at all carried beyond a very moderate degree, is supposed to give rise to softening of the brain, to epilepsy, and other symptoms of exhausted nerve-force. But I believe there is no truth whatever in this supposition: it remains a surmise only, arising probably from observation of a few cases of well-known individuals who, in common parlance, have worn their brains out. It is contradicted, in fact, by the great ages to which many of our statesmen, judges, magistrates, and literary men attain, whilst their mental powers are frequently preserved in full force to the last. It is more probable, too, and consonant with the analogies of the bodily powers, that the brain and nerves attain firmness and tone by active exercise, just as the muscular system does.

There is no doubt that very much depends upon the original constitution of the mind. In this respect the analogy of the muscular force does not quite hold. In the latter, exercise is *always* good, and by good management, and by proceeding gradually, may always be safely carried to a *high* degree. But in the case of the mind, individual character bears a more prominent part. No amount of training will convert a mind of originally small calibre into one of large ideas and extended sympathies. In fact, we can only

proceed *so far and no farther* with mental cultivation in any direction.

Amusement.—I have hitherto spoken of amusement as conducive to mental health only in an incidental manner. Its effects upon the habitual tone of the mind, when judiciously administered, are of the highest value. Its action upon the mind is like that of electricity upon the body. It removes weariness and cloudiness of perception, and restores the power of attention which long study has destroyed. It ought to be varied according to the strain to which either the bodily or the mental powers have been subjected; and should be, as far as possible, removed from any association with the ordinary employment of the day. By this means, wonder, admiration, and expectation are excited, all of which have a tendency to rouse the energies of the mind. Foster, in one of his delightful Essays, says that the amusements of hardworking intellectual men should always be of an exciting character, so as to rivet the attention whilst calling for no other kind of mental exertion. He counsels them to eschew dull and childish entertainments, as tending to produce *ennui* or even disgust.

The sum of all that can be said upon the subject, in so small a space as can be devoted to it in this place is this. The brain, like every other organ, requires periods of activity to be alternated with intervals of repose. The proportion which each should bear to the other, must depend upon the age, habits, and inherent powers of the individual mind. The proper relaxation for the young, and the natural complement to their severer studies, is found in observation and intimacy with the natural objects which surround them; these appeal to their senses at every turn, and by their novelty or peculiarity are well adapted to excite interest and attention.

I have already hinted, when speaking of bodily exercise, that the periods of study are, in most cases, too long: for most young people they ought not to exceed two hours at a time, although in the case of more than usual powers of application, this may be gradually extended. Men of business should seek their relaxation in studies or amusements of a nature the most opposite to those which occupy their attention in their business hours; as by so doing every part of the intellect may be brought into activity. The jaded mind should never seek relaxation in *mere change* of the subject of study or attention. The mind should be thrown altogether "out of gear;" it should lie fallow, taking care, however, that noxious weeds do not grow up to occupy the ground on which we intend to sow corn and wheat.

SECT. II. EXERCISE OF THE SENTIMENTS AND MORAL FACULTIES.

Exciting and Depressing Passions.—With reference to their effects upon the health of the mind, the moral and social sentiments may be divided into two classes—viz., the *Exciting* and the *Depressing* Emotions. By the first, we mean those emotions and desires from which the active or volitional powers take their rise. Such are *emulation*, *ambition*, *patriotism*, in their application to society and the world; and the more personal emotions of *joy*, *hope*, *love*, which are partly passive, partly active in their nature. All of these propel the moral force in a forward direction. They may be called *transitive* emotions, because their operation does not rest upon the individual who is the subject of them, but passes on to an object which may be one of desire or of love. They are essentially progressive in their tendency; looking forward is their characteristic quality, and hope is their basis.

The depressing passions, on the contrary, seem to be reflective or non-transitive in their nature. They chiefly concern the individual himself, and may arise and subside in the mind, yea, even dominate over its more active qualities, giving a colour of their own to the whole character, without their existence being known by any volitional exercise: such are *pride*, *conceit* (as distinct from vanity), *fear*, *sorrow*, *despair*. All of these depress the powers, both of body and mind, by their restraining action; and there is great reason for believing that this is effected by their sedative action upon the heart, whereby less blood than usual is sent to the brain, and the evolution of nervous force diminished in consequence. Their effect upon the individual is to wrap him up in a false appreciation of his own importance; and he gets angry with the world for not evincing the same high estimate of his abilities or worth as he has himself formed of them. Some of them, such as fear and despair, check the desire for action, by the morbid fear of ridicule or failure. In either case, there is nothing *active*. The state of mind is wholly passive and *introspective*. Its possessor is too much taken up with his own feelings or his own wrongs, and is disposed to retire from the struggle of life under the persuasion that every man's hand is against him, and that he is not made for success.

Amongst those whom a *constitutional timidity* withholds from making the efforts necessary to success in life are doubtless many minds of a rare order. Sensitive and high-principled, they are early disgusted with the chicane and false pretensions of grosser minds. Their scrupulous conscientiousness cannot suffer deception, which they regard as dishonesty; nor self-assertion and boasting, which they look upon as acted falsehood. At the first encounter with the actual

world, they are knocked over whilst considering how they shall get along in the stream without mingling with it; and, shocked at the rudeness, they shrink from a second encounter.

Much allowance ought to be made by rougher natures for these children of a finer clay. They are before their time, and may be looked upon as the advanced guards of a higher and more spiritual civilization. The ignorance and rudeness of the world are all too crass and massive for their delicate physique to make head against: so they retire within themselves, to grieve over their lot in being so out of accord with the times in which they are cast, or else to spin their brains and throw off thoughts which, like sparks of fire, shall burn up all before them, when once some suitable material has been found to start the conflagration.

I have elsewhere hinted that the different temperaments of the body depend upon some nice peculiarity of organization. It must be the same with the mind. Its temperament varies, by the most delicate shades, in every individual; and although, by calling into play qualities antagonistic to the natural bent of the disposition, these differences may, to a certain extent, be equalized, they are never altogether obliterated. The highest results are only obtainable by allowing these distinctive qualities to exhibit and develope themselves, by affording them opportunities for culture and expansion. It is necessary to bear in mind that we are not now considering the amount of intellectual or moral development which comports most with a healthy and strong corporeal frame. As Mr. Mayo observes, if "health and long life were the only considerations, the mind should not be raised to its full powers of exertion, or have all its energies called out and strenuously employed. For health and long life, there is no doubt

that an indifference to great objects, a succession of light and frivolous pursuits, a heart gradually toned down to insensibility to moral obligations and religious duties, would (strange enough) be no unfitting means."

But who can desire a long life conducted in this manner? Is it to be wished that one's time should be passed like a vegetable, in simply imbibing the food the soil affords and the warmth showered upon it by the rays of the sun; without feeling, without affection; with no knowledge of things around, above, beneath; with no bonds of relationship with any other creature except merely such as is requisite for the perpetuation of the species?—and, in many cases, so much does the love of self exclude the possibility of any other, that this relationship might be removed without loss to the individual.

Truly to live, the whole nature of man must be developed, must grow to its utmost stature, and should be extinguished only when the weakness which pervades humanity will permit no further stretch of its faculties; and when, to soar higher, it becomes requisite entirely to disconnect the soul from the trammels of the flesh, which tie it down to sense and matter; or else to lay aside the more gross and corruptible qualities of which the bodily substance is now possessed, retaining only those more *recondite*, yet not on that account less probable, qualities of matter which may still afford the spirit a dwelling-place, not wholly dissociated from the world of sense, but capable of passing, in union with it, into those ethereal realms where spirit may encounter spirit, and where light and knowledge may pass in and out as pleasant guests, without the necessity of such painful preparation, as, in this life, is always requisite for their entertainment.

Necessity for cultivating all the Moral Faculties.—In point of fact, the cultivation of *all* the moral

faculties, with the affections and desires, is entirely necessary to the well-being of man. They have all their proper office to subserve in the economy of the world; and in following up their bent and inclination, what we have to look to is the proper balancing of opposing appetites and passions, and directing them all, as it is quite possible to do, to the attainment of as good ends as our imperfect nature will admit of.

And here we will ask whether the present aspect of our social state favours the belief that all the means possible for maintaining this just balance of the propensities and affections, which moralists are so fond of praising, are being used by educated persons? The present has been called the age of *hurry:* it is also one of *worry*. Material wealth has acquired such a preponderating influence as to attract towards its attainment all the faculties of the mind, until the means are confounded with the end; and the appreciation and taste for the pleasures of the intellect and of active benevolence are wasted and lost in the excitement of the race after rank and fortune, which are too often only attained when they can be no longer enjoyed.

With regard to the affections, they fare no better. Strong minds are continually sacrificing their legitimate enjoyment to what they consider the paramount claims of wealth or ambition. Marriage is postponed lest it should, by its consequences, cause embarrassment and anxiety, and place the married man at a disadvantage in the race after the good things of life. All sorts of irregular connexions are consequently formed (as they cannot help to be) which, by becoming entanglements, bring an increase of anxiety, pain, and remorse. It happens, too, that in this battle of life, the lighter and less earnest spirits, finding themselves outrun and defeated in the contest, fall back upon frivolous and sensual pursuits, and so sink in the moral as well as in the social scale.

The fault of the present system seems, then, to consist in inducing youth to concentrate all its powers upon the attainment of some *one* end. Concentration of effort, though perhaps essential to *perfect* success in any calling, is prejudicial to the mind as a whole. Very successful men are rarely amiable: they have shown so little consideration for the rights and claims of others, in the long struggle for precedence, that they come to look upon their own interest as the mainspring of their actions, and to see justice and courtesy only when they are placed in a direct line with the goal towards which they are bound. They are, moreover, envious and jealous; feeling that they are obliged to hold on to the upper rounds of the social ladder for dear life, lest they should be plucked off by those who are squeezing and pressing below.

Now, I think I may venture to affirm that it is this concentration of the mind towards one set of ideas, one object of desire, which is frequently followed by that miserable break-down which, often at the very moment of fruition, afflicts the devotees of a mistaken ambition. Softening of the brain, and its accompanying paralysis of bodily and mental power, or, if not so bad as that, shattered health, *ennui*, and listlessness, mark the irreparable injury which all the powers have received from the prolonged strain upon them. Is it not this dangerous system which has made the annual holiday such an "institution" among us? I do not mean to say that perfect rest from the anxieties and worry of business, or literary labour, for a considerable time every year is not a good thing; but I fear that it derives its special goodness from being a *necessity*, the only thing which gives the rolling machinery any rest at all, and, by oiling the wheels and springs, preventing it from rapidly wearing out by unceasing friction.

The exact *modus operandi* of this injurious action

is not easy to define. But we have good reason for believing that circumstances analogous to those which are known to injure the normal functions of the body, have a similar operation upon the mind. By the excessive development of some of the mental qualities, which constant attention to them produces, others must be stunted and dwarfed. The nutrient power of the brain and mind thus becomes partial in its operation, and a want of balance is set up which, the longer it is continued, the greater is the departure from healthy action produced by it.

Those less showy qualities of the mind which are thus cast into the shade, may be, and I think are, the very ones whose influence is required as a check to, and moderator of, the excessive action of the rest. The successful pursuit of one favourite object makes the character self-asserting and boastful, requiring the check of meekness and humility. But where are these qualities to be found? Where have they been banished to? What has become of courtesy of manner, and of the gentle consideration for the feelings of others out of which it sprang? Where is the precept to do unto others as we would they should do unto us? And can that mind be said to be in a healthy state which cannot find these qualities within itself?

There is another way in which this ruling passion tends to disorder the true balance of the moral sentiments, and so contributes to swell the heavy and increasing list of acknowledged and unacknowledged aliens from mental health. The world, it is true, worships success, and is not over-nice to mark the means by which success is attained. Comparatively few, however, of its devotees are happy. Every now and then a sudden flash of conscience suffuses the surface of the mind, which, like blushing, is a painful feeling. There are recollections of unfair means used, of too sharp practice, and of the suffer-

ing cry or look of those who have been rudely pushed aside in the race, which give many a stab of anguish in the still hours of nocturnal reflection.

It is now that the neglect to cultivate counter-feelings, and opposite faculties to those in question, finds its Nemesis. There has not been laid up a store of beneficent actions and charitable thoughts to satisfy the innate love of our own species; no courtesies of business, and no manly preference of the claims of others, when conscience tells us that they are better than our own, to cheer the soul with self-approbation in its hours of weariness and gloom.

That state of mind which is often induced by want of success (and from the nature of things it must happen to many), whether from inferior ability, want of opportunity, or the unfair conduct of others, is generally of an unhealthy character. An abiding sense of injustice is pretty certain to lead to envy, hatred, and a desire for revenge—passions which disturb the healthy balance of the mental functions more, perhaps, than any other. The domestic affections are passed by unenjoyed, because they are not sweetened by the pride of place or wealth; and apathy and indifference to the best feelings of our nature, contempt of the world and its objects, fall like a funereal pall over all the faculties both of mind and soul.

If I have dwelt for an unreasonable space upon what, after all, may be said to be only one form of misdirected moral strength, I must plead as my apology the magnitude which the evil of over-competition (and it is a progressive one) appears to me to have assumed in these latter days. If insanity is increasing, I am inclined to give to this state of worry its share of the blame. If diseases of the nervous system—softening of the brain, paralysis, and break-down of the whole system—are more

frequent than formerly, *stigmatizing our advancing civilization as an improvement of the species at the expense of the individual*, this hurry and worry must share the blame. If muscular degeneration, debility of the heart, leading to organic disease of the great viscera, are on the increase, we may blame the close confinement to business, and the absence of out-door recreation, caused by the race after riches, for the degeneracy.

The remedy for this state of things it is easier to point out than to enforce. Perhaps to say that every day should have its hours of relaxation, and every week its holiday, whilst pursuits of a less engrossing kind should be intermingled with the main business of life, will be thought to be too general and impracticable for general adoption. Even in our very amusements we are always in a hurry, and continental people laugh at us for even making a labour of our pleasures.

Shortening the hours of work—brain-work—interposing, in the case of the young, an interval of relaxation in the middle of the day; a more frequent half or whole holiday, to be spent in country pursuits, during which some favourite hobby may be indulged in, seem to the author to be the most feasible remedies in our power at present to administer.

But there is a still deeper source of moral mischief attached to the subject we have been considering. It is the increasing love of finery in dress and magnificence in household appointments. The annoyance caused by competition and failure in these respects, is a constant disturber of the equilibrium of the moral faculties. So long as poor men must keep up a state almost rivalling that of persons with ten times their means, there will be no end of this evil. But why cannot educated people of slender means combine to render refinement in a

cottage respectable? In these days, the same comforts, the same elegancies, may be enjoyed in a fifty-pound house, as in one at five hundred. Let the female section of the community look to this. Let them be satisfied with cheap refinements, and elegance and comfort in a small compass. Let them show the other sex that it is mind which gives gilding to the furniture and piquancy to the banquet. If they will do this, we may venture to affirm that the lament of the Belgravian Matrons for the enforced maidenhood of their daughters will cease to be heard; and that the blush of shame which now suffuses those daughters' cheeks at seeing themselves neglected for rouged and enamelled ANONYMÆ will disappear. Further, by such a reform in the sentiments of those whose mission it is to preside over the comforts of home, the feet of the ambitious youth of the other sex will be withheld from a course which is fast leading them to the edge of a *moral bog*, into which, once precipitated, both their intellectual and moral faculties become so begrimed with filth, as never again to exhibit the true lineaments of humanity.

None but the medical practitioner who has made these dark shades of moral decadence his study can fully know the sad effects which they produce upon the tone of the whole organization. The inward and hidden consciousness of demerit depresses and perverts the activity of both mental and corporeal powers. The common observer sees deranged bodily health, inanity of mind, and perverted views of man's highest interests, but he is unable to fix upon their actual cause. The skilful physician knows that their cure (if to be attained at all) depends upon remedies which he, the moralist, and the religious guide, must combine to administer.

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THE END.